



IASc-DBT Gandhi Lecture Series

Science and the Future of Humanity

*A tribute to Mahatma Gandhi
on his 150th Birth Anniversary*

Edited by Partha P. Majumder

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Organized by

INDIAN ACADEMY OF SCIENCES

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DEPARTMENT OF BIOTECHNOLOGY, GOVT. OF INDIA



INDIAN ACADEMY OF SCIENCES

Bengaluru

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Foreword

We are all familiar with Gandhian thought and principles – we are taught these when we embark on the long journey of education and knowledge. Each year, we celebrate the birth and life of the Mahatma with thoughtful events and well-worded notes. And then we all go back to work and keep these principles and thoughts aside until we need them again the next year. Too few of us embody these principles in our daily life and work, and truly understand the import of the Mahatma’s principles in modern day life.

The power of science and innovation to do good for humanity is immense, but its propensity for good is matched by its ability for destruction. Without the core principles of humanity and Satya and Ahimsa, the core of Gandhian thought, we risk losing far more than we may gain. The Mahatma himself said, in a well-known speech to students in Trivandrum in 1925, “I think we cannot live without science, if we keep it in its right place”.

The Mahatma’s belief that ‘Science without humanity’ is a social sin is one that is as apt today, as when it was first said.

It is for this reason that I am very pleased that the Indian Academy of Sciences and the Department of Biotechnology have instituted the Mahatma Gandhi Lecture Series on Science and the Future of Humanity. This series of lectures, delivered by some of the most eminent experts and thought leaders in this space, span the spectrum of conversations on environmental sustainability, innovation culture, solidarity, ethics and several others. These topics are even more relevant today, in the current scenario. These are food for thought as we prepare the next generation of scientists, researchers, academics and others to solve some of the greatest societal challenges that we face today.

I would like to congratulate the speakers, the Indian Academy of Sciences and the Department of Biotechnology for this important initiative.

RENU SWARUP

*Secretary, Department of Biotechnology,
Government of India, New Delhi*

Preface

Mahatma Gandhi's 150th birth anniversary was celebrated globally in 2019. On this occasion, the Indian Academy of Sciences initiated activities that had the potential of leaving a lasting impact on the minds of our citizens.

Mohandas Karamchand Gandhi was a firm believer in the power of science for the development of humanity. He has said, "*Science is essentially one of those things in which theory alone is of no value whatsoever. Unless our hands go hand in hand with our hearts, we would be able to do nothing*". He said, "*Attainment of world peace is impossible except for greater scientific precision*". Gandhi also identified "*science without humanity*" as a cause for the ills of humankind.

Many have said that Gandhi rejected modern science. This is very far from the truth. Gandhi sought to humanize modern science. He summarized his views on modern science and scientists in a speech that he delivered to a group of college students in Trivandrum in March 1925. He said that "*It is a common superstition in India, ... that I am an opponent, a foe, of science. Nothing can be farther from the truth ... I think we cannot live without science, if we keep it in its right place. But I have learnt so much during my wanderings in the world about the misuse of science that I have often remarked, or made such remarks, as would lead people to consider that I was really an opponent of science. In my humble opinion there are limitations even to scientific search, and the limitations that I place upon scientific search are the limitations that humanity imposes upon us.*"

It is clear that Gandhi was a firm believer that science should work towards the upliftment of humanity. Today, we stand at crossroads: On the one hand, we have awesome feats of science that have made a difference to millions of lives, such as the invention of vaccines to save millions and the use of genomics-guided agriculture that has increased the yield of crops and has helped overcome mass hunger. On the other hand, at the time of Gandhi's death in 1948, the population of India was about 361 million people; today it stands at about 1.4 billion. While the standards of living have improved for large sections of society, there are still large numbers that remain undernourished or malnourished. This number is possibly increasing, in spite of an increase in agricultural productivity. Will science and technology be able to provide solutions to this and other obvious problems that have arisen from increasing populations worldwide? How will India and the planet cope with serious issues such as climate change that threaten food production, livelihoods, health and ecosystem services that depend on the protection of biological diversity? Will it be prudent to adopt more sustainable use of natural resources and cut back on profligate

lifestyles that seem to be predicated on an inexhaustible supply of resources? Are humans intellectually programmed for prudence, or has evolution given humans and all organisms a short-term view that selects for short-term success stories that could actually lead to extinction in the long-term?

Gandhi was very clear that the world has enough for our needs but not for our greed. How then should humanity confront its aspirations in this century? Can science and technology alone provide the panacea for pressing problems? We need public discourses and debates on these questions. We need to seriously discuss the future of humanity and the role of science in ensuring a sustainable, collegial, healthy and happy future for humankind.

The Gandhi Lecture Series was conceived to initiate such a discourse. We invited eminent scientists, humanists, philosophers, economists and historians from India and abroad to provide their perspectives on Science and the Future of Humanity. The prestigious journal *Nature* [574, 150 (2019)] has noted, “*As the world continues to grapple with how to respond to climate change, biodiversity loss, persistent poverty, and poor health and nutrition, Gandhi’s commitment to what we now call sustainability is perhaps more relevant today than in his own time*”. And as Mr. R. Rajagopal in his editorial in *The Telegraph* on October 2, 2021, has written “... *the Gandhian voice is, in essence, the voice of conscience itself. The human race in spite of its reprehensible efforts across the ages has not managed to silence it yet*”.

The ten lectures on Science and the Future of Humanity were delivered by scholars of international eminence. All lectures were delivered online because of the SARS-CoV-2 pandemic. With the permission of the scholars, we have recorded their lectures and have already made these freely available on the website of the Academy via the Academy YouTube channel. We are now happy to publish this compendium of essays contributed by the scholars based on the lectures they had delivered.

I take this opportunity to thank the Fellows and Associates of the Academy in making this lecture series a grand success. I thank Mr. N Maheshchandra, Executive Secretary of the Academy, for his logistical support and Ms. M Srimathi, Executive Editor, for her efficient handling of the manuscripts and oversight of the production of this compendium. I also thank Mr. K Sumesh for providing the support that was required for smooth online transmission of these lectures. I thank the Department of Biotechnology, Government of India, for providing financial support to the Academy to organize this lecture series and to disseminate the views on “Science and the Future of Humanity” expressed by the eminent scholars.

PARTHA P. MAJUMDER
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1

HOW MUCH SHOULD A PERSON CONSUME? MAHATMA GANDHI AND THE ELUSIVE SEARCH FOR ENVIRONMENTAL SUSTAINABILITY*

IASc-DBT Gandhi Lecture: 30 January 2021

RAMACHANDRA GUHA

Distinguished University Professor, Krea University

I

This lecture takes as its point of departure a short and relatively obscure essay by the prolific and best-selling author, Harvard economist and sometime American ambassador to India, John Kenneth Galbraith. Galbraith wrote the essay in 1958, the same year that he published *The Affluent Society*, a book that wryly anatomised the social consequences of the mass consumption age. In his book, Galbraith had highlighted the “preoccupation with productivity and production” in post-war America and Western Europe. The population in these societies had, for the most part, been adequately housed, clothed and fed; now they expressed a desire for “more elegant cars, more exotic food, more erotic clothing, more elaborate entertainment”.

*This lecture is adapted from the last chapter of *How Much Should a Person Consume? Thinking Through the Environment* by Ramachandra Guha, Ranikhet: Permanent Black, 2008. Reproduced with the permission of the author and publisher.

YouTube lecture link: <https://www.youtube.com/watch?v=-tyLEACvSr8>

When Galbraith termed the 1950s America as the “Affluent Society”, he meant not only that this was a society most of whose members were hugely prosperous when reckoned against other societies and other times, but also that this was a society so dedicated to affluence that the possession and consumption of material goods became the exclusive standard of individual and collective achievement. He quoted the anthropologist Geoffrey Gorer, who remarked that in modern America, “any device or regulation which interfered, or can be conceived as interfering, with [the] supply of more and better things is resisted with unreasoning horror, as the religious resist blasphemy, or the warlike pacifism” [1].

Galbraith wrote the essay I speak of months after he published the book that made his name and reputation. The essay is provocatively titled, ‘How Much Should a Country Consume?’, and can be read as a reflective footnote to *The Affluent Society*. In the book itself, Galbraith had noted the disjunction between “private affluence and public squalor”, and how the single-minded pursuit of wealth had diverted attention as well as resources from the nurturing of true democracy, which he defined as the provision of public infrastructure, and creation of decent schools, parks and hospitals. In the essay, the economist turned his attention, all too fleetingly, to the long-term consequences of this collective promotion of consumption, and of the “gargantuan and growing appetite” for resources in contemporary America. The American conservation movement, he remarked, had certainly noted the massive exploitation of resources and materials in the post-war period. However, its response was to look for more efficient methods of extraction or the substitution of one material with another through technological innovation. There was, wrote Galbraith, a noticeable “selectivity in the conservationist’s approach to materials consumption.” For,

“if we are concerned about our great appetite for materials, it is plausible to seek to increase the supply, or decrease waste, to make better use of the stocks that are available, and to develop substitutes. But what of the appetite itself? Surely this is the ultimate source of the problem. If it continues its geometric course, will it not one day have to be restrained? Yet in the literature of the resource problem this is the forbidden question. Over it hangs a nearly total silence. It is as though, in the discussion of the chance for avoiding automobile accidents, we agree not to make any mention of speed!” [2]

A cultural explanation for this silence had been previously provided by the great Berkeley geographer, Carl Sauer. Writing in 1938, Sauer remarked that “the doctrine of a passing frontier of nature replaced by a permanent and sufficiently expanding frontier of technology is a contemporary and characteristic expression of occidental culture, itself a historical-geographical product”. This frontier attitude, he went on,

“has the recklessness of an optimism that has become habitual, but which is residual from the brave days when north-European freebooters overran the world and put it under tribute”. Warning that the surge of growth at the expense of nature would not last indefinitely, Sauer – speaking for his fellow Americans – noted wistfully that “we have not yet learned the difference between yield and loot. We do not like to be economic realists” [3].

John Kenneth Galbraith had identified two major reasons for the silence with regard to consumption. One was ideological, the worship of the Great God – Growth. The principle of Growth (always with that capital G) was a cardinal belief of the American people; it necessarily implied a continuous increase in the production of consumer goods. The second reason was political – the widespread scepticism of the State, for the America of the 1950s had witnessed the “resurgence of a notably over-simplified view of economic life which [ascribed] a magical automatism to the price system”. Now Galbraith was himself an unreconstructed New Dealer, who would tackle the problem of over-consumption as he would tackle the problem of under-employment, that is, through purposive State intervention. At the time he wrote, however, free-market economics ruled and “since consumption could not be discussed without raising the question of an increased role for the state, it was not discussed” [4].

Four years later, Rachel Carson published *Silent Spring*, and the modern American environmental movement gathered pace. Would not one have expected this new voice of civil society to undertake what the market could not? As it happened, consumption continued to be the great unasked question of the conservation movement. The movement principally focused on two things: the threats to human health posed by pollution, and the threats to wild species and habitats posed by economic expansion. The latter concern became, in fact, the defining motif of the movement. The dominance of wilderness protection in American environmentalism has promoted an essentially ‘negativist’ agenda – the protection of national parks and their animals by freeing them of human habitation and productive activities. As the historian Samuel Hays points out, “natural environments which formerly had been looked upon as ‘useless’ waiting only to be developed, now came to be thought of as ‘useful’ for filling human wants and needs. They played no less a significant role in the advanced consumer society than did such material goods as hi fi sets or indoor gardens” [5]. While saving these islands of biodiversity, environmentalists paid scant attention to what was happening outside them. In the American economy as a whole, the consumption of energy and materials continued to rise.

A perceptive, and home-grown, critic of this selective environmentalism was the poet Wendell Berry. In an essay published in 1987, Berry rejected “an assumed division or divisibility between nature and humanity, or wildness and domesticity”. In his view, “conservation is going to prove increasingly futile and increasingly meaningless if its proscriptions and forbiddings are not positively answered by an economy that rewards and enforces good use”. He was himself of the conviction that “the wildernesses cannot survive if our economy does not change” [6].

In the American context, Wendell Berry was – the metaphor is inescapable – a voice in the wild. For, the growing popular interest in the wild and the beautiful not merely accepted the parameters of the affluent society, but was wont to see nature itself as merely one more good to be consumed. The uncertain commitment of most nature lovers to a more comprehensive environmental ideology is illustrated by the paradox that they were willing to drive thousands of miles, using up scarce oil and polluting the atmosphere, to visit national parks and sanctuaries, thus using anti-ecological means to marvel in the beauty of forests, swamps or mountains protected as specimens of a ‘pristine’ and ‘untouched’ nature.

The selectivity of the conservationist approach to consumption was underlined in the works of biologists obsessed with the ‘population problem’. Influential American scientists such as Paul Ehrlich and Garret Hardin identified human population growth as the single most important reason for environmental degradation. This is how Ehrlich began the first chapter of his best-selling book, *The Population Bomb*:

“I have understood the population explosion intellectually for a long time. I came to understand it emotionally one stinking hot night in Delhi a couple of years ago. My wife and daughter and I were returning to our hotel in an ancient taxi. The seats were hopping with fleas. The only functional gear was third. As we crawled through the city, we entered a crowded slum area. The temperature was well over 100, and the air was a haze of dust and smoke. The streets seemed alive with people. People eating, people washing, people sleeping. People visiting, people arguing and screaming. People thrusting their hands through the taxi window, begging. People defecating and urinating. People clinging to buses. People herding animals. People, people, people, people.” [7]

Here, exploding numbers are blamed for increasing pollution, stinking hot air and even technological obsolescence (that ancient taxi!). Through the 1970s and 80s, Neo-Malthusian interpretations gained wide currency. Countries such as India and, especially, Bangladesh, were commonly blamed for causing an environmental crisis. Not surprisingly, activists in these countries were quick to take offence, pointing out that the United States of America consumes, per capita as well as in the aggregate, a

far greater proportion of the world's resources. Indeed, it is the industrialised countries, led by the United States, who have been principally responsible for the build-up of greenhouse gases over the past hundred and fifty years.

Southern scholars and activists like to argue that the real 'population problem' is in America, since the birth of a single child there would have the same impact on the global environment as the birth of, say, seventy Indonesian children. There was a Bangladeshi diplomat who made this case in the United Nations and elsewhere, whenever he could. But after a visit to an American supermarket, he was obliged to modify his argument to claim, instead, that the birth of an American dog (or cat) was the equivalent – ecologically speaking – of the birth of a dozen Bangladeshi children [8].

Arguments like this, when presented or published in the United States, tend to lay one open to the charge of 'anti-Americanism'. So let me make it clear at once that I consider America to be, in many respects, a model for the world. Within its borders, it is far and away the most democratic of all the countries that claim membership of the United Nations. Over the years, I have often been struck by the dignity of labour in America, by the ease with which high-ranking Americans carry their own loads, fix their own fences and mow their own lawns. This, it seems to me, is part of a wider absence of caste or class distinctions that would be simply unthinkable in Europe or, indeed, India. Unlike these other places, here one can actually travel from the log-cabin to the White House, as witness the careers of Honest Abe in the 19th century and Dishonest Bill in the 20th century.

Left-wing intellectuals have tended to downplay these American achievements: the respect for the individual, the remarkable social mobility, and the searching scrutiny to which public officials and state agencies are subjected. They see only the imperial power, the exploiter, and the bully – the invader of faraway lands and the manipulator of international organisations to serve the interests of the American economy.

Liberals and libertarians, whether American or not, salute the robustly democratic traditions of the United States. Socialists and anti-imperialists, whether American or not, castigate the bullying and overbearing instincts of the United States. Neither side is willing to see the other side. For, the truth about America is that it is at once deeply democratic and instinctively imperialist. This curious co-existence of contrary values is certainly exceptional in the history of the world. Other democratic countries, such as Sweden and Norway at the present time, are not imperialist. Scandinavian countries honour their international obligations and (unlike the Americans) generously support social welfare programmes in the poorer parts of the world. Other imperialist countries, such as France and Great Britain in the past, were not properly democratic.

In the heyday of European expansion, men without property and all women did not have the right to vote. Even after suffrage was extended, British governments were run by an oligarchy. The imagination boggles at the thought of a Ken Starr examining the sexual and other peccadilloes of a Benjamin Disraeli.

My own view is that the link between democracy at home and imperialism abroad is provided by the American consumer economy and its apparently insatiable greed for the resources of other lands. Contrary to what Wendell Berry thought, the wildernesses at home continued to be protected but only because the ecological footprint of the American consumer grew and grew. The free-booting instincts of the pioneer, once set loose on the lands to the West that were formally part of the nation, now found play in lands and waters east, south and north – whether these belonged to America or not.

II

I would now like to contrast the American case with the German one. Environmentalists in Germany have been more forthright in their criticisms of the consumer society. “The key to a sustainable development model worldwide”, writes Helmut Lippelt, “is the question of whether West European societies really are able to reconstruct their industrial systems in order to permit an ecologically and socially viable way of production and consumption”. That Lippelt does not include the U.S. or Japan is noteworthy, an expression of his (and his movement’s) willingness to take the burden upon themselves. West Europeans should reform themselves, he writes, rather than transfer their existing “patterns of high production and high consumption to eastern Europe and the ‘Third World’ [and thus] destroy the earth” [9]. For the German Greens, economic growth in Europe and North America has been made possible only through the economic and ecological exploitation of the Third World. The philosopher Rudolf Bahro was characteristically blunt: “The present way of life of the most industrially advanced nations”, he remarked in 1984, “stands in a global and antagonistic contradiction to the natural conditions of human existence. We are eating up what other nations and future generations need to live on”. From this perspective, “The working class here [in the North] is the richest lower class in the world. And if I look at the problem from the point of view of the whole of humanity, not just from that of Europe, then I must say that the metropolitan working class is the worst exploiting class in history. . . . What made poverty bearable in eighteenth or nineteenth-century Europe was the prospect of escaping it through exploitation of the periphery. But this is no longer a possibility, and continued industrialism in the Third World will mean poverty for whole generations and hunger for millions.” [10]

Bahro was a famous ‘Fundl’, a leader of that section of the German Greens which stood in the most uncompromising antagonism to modern society. But even the most hard-headed members of the other, ‘Realo’, faction acknowledged the unsustainability, on the global plane, of industrial society. The parliamentarian (and future Foreign Minister) Joschka Fischer, when asked by a reporter where he planned to spend his old age, said: “In the Frankfurt cemetery, although by that time we may pose an environmental hazard with all the poisons, heavy metals and dioxin that we carry around in our bodies”. Or, as a party document more matter-of-factly put it: “The global spread of industrial economic policies and lifestyles is exhausting the basic ecological health of our planet faster than it can be replenished”. This global view, coupled with the emphasis on accountability, called for “far-reaching voluntary commitments to restraint by wealthy nations”. The industrialised countries, who consume three-fourths of the world’s energy and resources, and contribute the lion’s share of “climate-threatening gaseous emissions”, must curb their voracious appetite while allowing Southern nations to grow out of poverty. Green theorists ask for the cancellation of international debt, the banning of trade in products that destroy vulnerable ecosystems and, most radical of all, for the freer migration of peoples from poor countries to rich ones [11].

These elements in the Green programme were, of course, forged as an alternative to the policies promoted by the two dominant political parties in Germany who were themselves committed to the great God – Growth. Between 1998 and 2005, the Greens found themselves sharing power at the Federal level as junior partners, but partners nevertheless, in a coalition dominated by the Social Democrat. Being in power certainly tamed them. They now worked only for incremental change, instead of the wholesale restructuring of the consumption and production system that some of them had previously advocated.

The critique of over-consumption made manifest by the German Greens is not absent in other European environmental traditions. A few months prior to the Earth Summit of 1992, the Dutch Alliance of Sustainable Development invited four Southern scholars to write a report on the Dutch economy and environment. A Brazilian anthropologist, an Indian sociologist, a Tanzanian agronomist and an Indonesian activist (two men and two women) spent six weeks in Holland talking to a wide cross-section of citizens and public officials. Their report focused on the Dutch “addiction to affluence”, as revealed in an over-reliance on the motor-car, a dependence on the lands and resources of other countries, and high levels of pollution. The foreign critics posed the sharp question, “Can Dutch society put limits to itself?” They thought, optimistically, that the developed democratic culture of the Netherlands did offer pos-

sibilities of self-correction but for that to work political action had to be accompanied by technical change, by the exercise of individual restraint, and by a wider social resolve to share their wealth with the less-advantaged societies of the South [12].

It says something about Dutch environmentalists that they extended this invitation in the first place. At the risk (once more) of being called anti-American, it must be said that one cannot easily imagine the Sierra Club initiating such an examination.

III

Fifty years before the founding of the German Green party, and thirty years before the article by Galbraith with which this lecture began, an Indian politician had pointed to the unsustainability, at the global level, of the Western model of economic development. “God forbid”, he wrote, “that India should ever take to industrialization after the manner of the West. The economic imperialism of a single tiny island kingdom (England) is today keeping the world in chains. If an entire nation of 300 million took to similar economic exploitation, it would strip the world bare like locusts” [13].

This was Mahatma Gandhi writing in his journal *Young India* in December 1928. Two years earlier, Gandhi had claimed that to “make India like England and America is to find some other races and places of the earth for exploitation”. As it appeared that the Western nations had already “divided all the known races outside Europe for exploitation and there are no new worlds to discover”, he pointedly asked, “What can be the fate of India trying to ape the West?” [14]

Gandhi’s critique of Western industrialisation has, of course, profound implications for the way we live and relate to the environment today. For him, “the distinguishing characteristic of modern civilization is an indefinite multiplicity of wants” whereas ancient civilizations were marked by an “imperative restriction upon, and a strict regulating of, these wants” [15]. In uncharacteristically intemperate tones, he spoke of his “wholeheartedly detest[ing] this mad desire to destroy distance and time, to increase animal appetites, and go to the ends of the earth in search of their satisfaction. If modern civilization stands for all this, and I have understood it to do so, I call it satanic” [16].

At the level of the individual, Gandhi’s code of voluntary simplicity also offered a sustainable alternative to modern lifestyles. One of his best known aphorisms, that the “world has enough for everybody’s need, but not enough for everybody’s greed”, is in effect, an exquisitely phrased one-line environmental ethic. This was an ethic he himself practiced: for, resource recycling and the minimization of wants were integral to his life. Gandhi’s arguments have been revived and elaborated by the current generation of Indian environmentalists. India today is veritably an ecological disaster

zone, marked by high rates of deforestation, species loss, land degradation, and air and water pollution. The consequences of this abuse of nature have been chiefly borne by the poor in the countryside – the peasants, tribals, fisherfolk and pastoralists who have seen their resources snatched away or depleted by more powerful economic interests. In the last few decades, those who rule India have attempted precisely to “make India like England and America”. Without the access to resources and markets enjoyed by those two nations when they began to industrialise, India has had perforce to rely on the exploitation of its own people and environment. The natural resources of the countryside have been increasingly channelised to meet the needs of the urban-industrial sector; the diversion of forests, water, minerals, etc., to the elite accelerated processes of environmental degradation even as it deprived rural and tribal communities of their traditional rights of access and use. Meanwhile, the modern sector has moved aggressively into the remaining resource frontiers of India – the Northeast, and the Andaman and Nicobar islands. This bias towards urban-industrial development has resulted only in a one-sided exploitation of the hinterland, thus proving Gandhi’s contention that “the blood of the villages is the cement with which the edifice of the cities is built” [17].

The preceding paragraph brutally summarises the arguments and evidence provided in a whole array of Indian environmentalist tracts [18]. Simplifying this still further, one might say that the key contribution of the Indian environmental movement has been to point to the inequalities of consumption *within* a society (or nation). In this respect, Indian environmentalists complement the work of their German counterparts, who have most effectively highlighted the inequalities of consumption *between* societies and nations.

The criticisms of these environmentalists are strongly flavoured by morality, the sheer injustice of one group or country consuming more than its fair share of the earth’s resources, and the political imperative of restoring some semblance of equality in global and national consumption. I now present an analytical framework that might more dispassionately explain these asymmetries in the patterns of consumption [19]. Derived in the first instance from the Indian experience, this model rests on a fundamental opposition between two groups, termed *omnivores* and *ecosystem people* respectively. The two groups are distinguished above all by the size of their ‘resource catchment’. Thus, omnivores, who include industrialists, rich farmers, state officials and the growing middle class based in the cities (estimated at in excess of 100 million), have the capability to draw upon the natural resources of the whole of India to maintain their lifestyles. Ecosystem people, on the other hand– who would include about two-thirds of the rural population (say about 400 million people) –

rely for the most part on the resources of their own vicinity, from a catchment of a few dozen square miles at best. Such are the small and marginal farmers in rain-fed tracts, the landless labourers, and also the heavily resource-dependent communities of hunter-gatherers, swidden agriculturists, animal herders and wood-working artisans, all stubborn 'pre-modern' survivals in an increasingly 'post-modern' landscape.

The process of development in independent India has been characterised by a basic asymmetry between the omnivores and the ecosystem people. A one-sentence definition of economic development, as it has unfolded over the last sixty years, would be: "Development is the channelizing of an ever increasing volume of natural resources, through the intervention of the state apparatus and at the cost of the state exchequer, to subserve the interests of the rural and urban omnivores". Some central features of this process have been:

1. The concentration of political power/decision-making in the hands of omnivores.
2. Hence, the use of the State machinery to divert natural resources to islands of omnivore prosperity, especially through the use of subsidies. Wood for paper mills, fertilizers for rich farmers, and water and power for urban dwellers, have all been supplied by the State to omnivores at well below market prices.
3. The culture of subsidies has fostered an indifference of omnivores to environmental degradation caused by them; this is compounded by their ability to pass on its costs to ecosystem people or to the society-at-large.
4. Projects based on the capture of wood, water or minerals – such as eucalyptus plantations, large dams or open-cast mining – have tended to dispossess the ecosystem people who previously enjoyed ready access to those resources. This has led to a rising tide of protests by the victims of development – Chipko, Narmada and dozens of other protests that we know collectively as the 'Indian environmental movement'.
5. But development has also *permanently* displaced large numbers of ecosystem people from their homes. Some twenty million Indians have been uprooted by steel mills, dams, and the like; countless others have been forced to move to the cities in search of a legitimate livelihood denied to them in the countryside (sometimes as a direct consequence of environmental degradation). Thus has been created a third class, of *ecological refugees*, living in slums and temporary shelters in the towns and cities of India.

This framework, which divides the Indian population into the three socio-ecological classes of omnivores, ecosystem people, and ecological refugees, can help us understand why economic development has destroyed nature but also failed to remove poverty. The framework synthesises the insights of ecology with sociology in that it distinguishes social classes by their respective resource catchments, cultures and styles of consumption, and also their widely varying powers to influence state policies.

The framework is analytical as well as value-laden, descriptive and prescriptive. It helps us understand and interpret nature-based conflicts at various spatial scales: from the village community upwards through the district and region on to the nation. Stemming from the study of the history of modern India, it might also throw light on the dynamics of socio-ecological change in other large, rapidly industrialising countries such as Brazil and Malaysia, where too have erupted conflicts between ‘omnivores’ and ‘ecosystem people’, and whose cities are likewise marked by a growing population of ‘ecological refugees’. At a pinch, it might explain asymmetries and inequalities at the global level, too. It was in the middle of the 19th century that a German radical proclaimed, ‘Workers of the World, Unite!’ But as another German radical [20] once reminded this writer, the reality of our times is very nearly the reverse – the process of globalisation whose motto might very well be, ‘Omnivores of the World, Unite!’

IV

What then is the prospect for the future? There are, at present, two alternative answers to this question. One answer guides the work of the institutions that constitute the so-called ‘Washington Consensus’. It also informs the economic policies of most national governments. The other answer animates the activism of the environmental and anti-globalisation movements.

I call the first alternative, ‘The Fallacy of the Romantic Economist’. This states that everyone can become an omnivore, if only we allow the market full play. When, back in 1972, resource scientists had raised the question of ‘Limits to Growth’, the economist Wilfrid Beckerman claimed that there was “no reason to suppose that economic growth cannot continue for another 2,500 years” [21]. The optimism was wholly characteristic of a profession mistakenly dubbed as the ‘dismal science’. And with the fall of the Berlin Wall, the optimism was reinforced and renewed. Economists everywhere are the cheerleaders for the processes of globalisation now unfolding, processes which, in their view, promise a universalisation of American styles of consumption.

My own opinion is that aspects of economic globalisation are indeed welcome. These include the free flow of information, the inducements to innovation and the encouragement to entrepreneurship. In countries like China and India, retreat of the State from the economy has led to much quicker rates of economic growth. All this has greatly augmented human welfare in the short-term. The long-term prospects are more worrying. One problem, foregrounded by Left-wing critics, is that the fruits of economic growth have been very unevenly distributed. Although, in both India and China aggregate poverty has substantially reduced, there remain large pockets of deprivation.

The problem of *equity* can perhaps be mitigated by purposive social policies, spreading education and health across the board, and nurturing opportunities for growth among communities and regions who appear to be ‘falling behind’. Less tractable is the problem of *ecology*.

Consider thus the spread of personalised transport in China, where, as it was once in America, the possession of a car is the one true sign that a human being has become properly modern. As *The Economist* magazine approvingly reports, the car is seen by the middle-class Chinese as the “symbol of freedom and status”. In 2002, the demand for cars in China increased by 56% and in 2003, 75%. In 2004, the State news agency *Xinhua* proclaimed that “China has begun to enter the age of mass car consumption. This is a great and historic advance”. Shanghai has a Formula One race-track now, costing \$320 million. The city will soon have a \$50 million car museum [22].

There has been a general reorganization of the ways of life in the past century, which the Americans have led, with the rest of the world panting behind them. The Chinese, relative latecomers to this race, are striving hard to catch up with the leaders. In the capital city, Beijing, one in six residents now have cars. But for the country as a whole the proportion is one in 125, way below the U.S. average, which is 6 in 10. But, as the quote from *Xinhua* indicates, the public and popular desire is for China to become, in these respects, exactly like America. And in the cities of modern India the feelings are the same. Here too there has been a rapid spread of the car; here too the sentiment among young professionals is that not to possess one is to be left out in the cold.

Consider the impact on the environment of the spectacular recent growth in the economy of my own home town, Bangalore. Within a generation, a once-sleepy cantonment has been transformed into a city of ten million, and an industrial and commercial hub. Although the growth has been led by a relatively ‘dematerialised’ industry, namely informational technology, the income generated and the desires spawned have had strikingly material effects. Bangalore now has an estimated 2 million motor

vehicles. A little over half of these run on two wheels: scooters and motorcycles. About a quarter are cars; the rest are buses, trucks and utility vehicles. These take metals to build, oil to run and roads to drive on, and, lest we forget, emit by no means harmless chemicals into the air. The massive influx of population has also caused a building boom – with large offices made of cement and glass, and larger apartment buildings, likewise consuming vast amounts of energy and materials.

A question never asked by economists (or by *The Economist*) is this – can the world, as a whole, achieve American levels of car ownership? Can there be a world with 4 billion cars, a China with 700 million cars and an India with 600 million cars? Where will the oil and gas to run them come from, the metals to build them with, and the tar for the roads to drive them on? And I take the car here as merely being indexical of a certain style of consumption. For with its use also come demands for other resources and goods. In China and India now, as in the America of the 1950s, with the wish to possess more elegant cars has come also the desire for more exotic food, more erotic clothing and more elaborate entertainment.

In a series of articles published a few years ago, the *New York Times* columnist Thomas Friedman wrote with alarm about the threats to the global environment posed by Chinese economic development. The billion-strong population of China, he said, uses 45 billion pairs of chopsticks every year, accounting for 25 million full-grown trees. Should they not move to eating with their fingers or with steel utensils instead? Speaking of the increasing energy consumption in China, he notes that a single shop in the city of Shenzhen sold one-thousand air-conditioners in a single hot weekend. “There is a limit to how long you can do that”, Friedman warned.

“What we don’t want”, wrote the *New York Times* columnist, is for China to protect its own environment and then strip everyone else’s in the developing world by importing their forests and minerals”. “China’s appetite for imported wood”, he points out, “had led to the stripping of forests in Russia, Africa, Burma and Brazil. China has just outsourced its environmental degradation”. This, said Friedman, “is why the most important strategy the U. S. and China need to pursue, in concert, is one that brings business, government, and NGOs together to produce a more sustainable form of development—so China can create a model for itself and others on how to do more things with less stuff and fewer emissions” [23].

Friedman might have added that China has only been doing for the past few decades what his own country has done for the past century: that is, protect its woods and forests while devastating the environments of other countries. Even now, it might help if the original sinner promotes a more sustainable form of development within its own borders. It still does more things with much more stuff and massive emissions

– facts that make its preaching to other countries so much harder to swallow. That said, the industrialisation of India and China does pose special problems, which are caused by the weight of sheer numbers. As Gandhi understood as early as in 1928, if the most populous nations sought to emulate the ecologically wasteful ways of the most powerful, they put in peril the very conditions of human survival on this earth. So, by the time Indians and Chinese reach American levels of consumption, will they have stripped the world bare like locusts?

When I once posed this question in a seminar at the University of California at Berkeley, a biology professor answered that the solution lay in developments in modern genetics. It would soon be possible, he said, to engineer adult human beings who were two feet tall and weighed, on an average, a mere 20 kilograms, but who had the brains and techniques to yet outwit and dominate the rest of the creation. This new race of Super (Small) Men would drive smaller cars on narrower roads to tiny offices from still more tiny homes. In other words, they could live more or less like the average American today, while consuming a fraction of the resources he did.

That prospect is, for the moment and perhaps for a long while yet, in the realm of fantasy. In the world we know and live in, what we see is India and China simply trying to become like England and America and thus, as Gandhi predicted, trying to “find some other races and places of the earth for exploitation”. The Chinese interest in Sudan or the Indian interest in Central Asia exactly parallels America’s interest in the Middle East. We can see the leaders of these ‘emerging’ economies emulate the leaders of the already emerged – travelling to obscure parts of the world, sniffing around for oil. Both countries are also, like America, expanding their military, and both are, like America again, refusing to endorse international agreements that would bind them to the more responsible use of natural resources.

Forget the rest of the world, then. All Chinese or Indians cannot become omnivores, either. The attempt to chase this fallacy will lead only to bitter social conflict and serious environmental degradation.

V

The alternative to the Fallacy of the Romantic Economist is what I call the ‘Fallacy of the Romantic Environmentalist’. This holds that ecosystem people want to remain ecosystem people. The fallacy comes in two versions: the ‘agrarian’ and the ‘primitivist’ or ‘deep ecological’. Let us consider them in turn.

In 1937, soon after he had moved to a village in central India to devote himself to rural reconstruction, Gandhi defined his ideal village as follows: “It will have cottages with sufficient light and ventilation, built of a material obtainable within a

radius of five miles of it. The cottages will have courtyards enabling householders to plant vegetables for domestic use and to house their cattle. The village lanes and streets will be free of all avoidable dust. It will have wells according to its needs and accessible to all. It will have houses of worship for all, also a common meeting place, a village common for grazing its cattle, a co-operative dairy, primary and secondary schools in which [vocational] education will be the central fact, and it will have Panchayats for settling disputes. It will produce its own grains, vegetables and fruit, and its own Khadi. This is roughly my idea of a model village.” [24]

In many respects, this is an appealing ideal: the emphasis on local self-reliance, a clean and hygienic environment, and the collective management and use of those gifts of nature so necessary for rural life – water and pasture. The problem is that Gandhi himself wanted it ‘generalised’. That is, in the India of his conception there would be 700,000 such villages running on ecological and moral lines. As for cities and factories, it was not clear what would happen to those that already existed; certainly new ones were not to be encouraged. A certain ‘statis’ was also implied: India was, and would always remain, a land of villages and villagers.

The anti-urban orientation of Gandhi was shared by his followers, such as J. C. Kumarappa, and it has been emphatically affirmed by his modern-day admirers. Contemporary Gandhian environmentalists, such as Medha Patkar and Sunderlal Bahuguna, see cities as corrupting and factories as polluting, this again in both senses – moral as well as ecological. The opportunities cities offer and the commodities factories produce are regarded as ephemeral to the good life. Certainly, their own work has been on protecting themselves and their constituencies from these inducements. The peasant must remain a peasant; indeed, they would say, he wants to remain a peasant [25].

The ‘ecosystem person’ of the deep ecological vision is more likely to be a hunter-gatherer than a subsistence farmer. Still, like the agrarian, the committed deep ecologist is resolutely opposed to the artefacts of modernity – technological, social or aesthetic. A contemporary effort to create such a Utopia in practice was initiated by Douglas Tompkins, an American billionaire who had a mid-life conversion experience and became a deep ecologist. Selling his clothing business for \$150 million, he bought a thousand square miles of Chilean forest and resolved to save it for posterity; save not just the forests but also the people who dwelled in it. He had a home built for himself, by local workmen using local methods, and employed local folk musicians playing timeless, or at least unchangeable, tunes. There was no electricity allowed in the campus and no cars, although an exception was made for the helicopter that brought the owner in and sometimes took him out. Otherwise, Tompkins kept

out “the global economy which was a threat to their traditional culture”. As a visiting journalist wrote, Tompkins did not merely seek to save the land and forests, he planned “to freeze the people in place” [26].

Strikingly, the environmental activists’ rejection of modernity is being reproduced in and by influential sections of the academic world. Anthropologists, in particular, are almost falling over themselves in writing epitaphs to development in works that seemingly dismiss the very prospects of directed social change in the world outside Europe and America. It is implied that development is a nasty imposition on the innocent peasant and tribal, who, left to himself, would not willingly partake of Enlightenment rationality, modern technology or modern consumer goods [27]. This literature has become so abundant and so influential that it has even been anthologised in a volume called (what else!) *The Post Development Reader* [28].

The editor of this volume was a retired Iranian diplomat now living in the South of France. The authors of those other demolitions of the development project were, without exception, tenured professors at well-established Western universities. I rather suspect that the objects of their sympathy would cheerfully exchange their own social position with that of their chroniclers. For, if it is impossible to create a world peopled entirely by omnivores, it is equally a fallacy that ecosystem people want to remain as they are, that they do not want to enhance their own resource consumption. I think the tenured critics of ‘development’ and ‘modernity’ need to be reminded of these words of the late Raymond Williams, here speaking of his boyhood in Wales:

“At home we were glad of the Industrial Revolution, and of its consequent social and political changes. True, we lived in a very beautiful farming valley, and the valleys beyond the limestone we could all see were ugly. But there was one gift that was overriding, one gift which at any price we would take, the gift of power that is everything to men who have worked with their hands. It was slow in coming to us, in all its effects, but steam power, the petrol engine, electricity, these and their host of products in commodities and services, we took as quickly as we could get them, and were glad. I have seen all these things being used, and I have seen the things they replaced. I will not listen with any patience to any acid listing of them—you know the sneer you can get into plumbing, baby Austins, aspirin, contraceptives, canned food. But I say to these Pharisees: dirty water, headaches, broken women, hunger and monotony of diet. The working people, in town and country alike, will not listen (and I support them) to any account of our society which supposes that these things are not progress: not just mechanical, external progress either, but a real service of life.” [29]

This point can be made as effectively by way of anecdote. In 1994, a group of Indian scholars and activists gathered in the southern town of Manipal for a national

meeting to commemorate Mahatma Gandhi's 125th birth anniversary. They spoke against a backdrop of a life-size portrait of Gandhi, clad in the loincloth he wore for the last thirty years of his life. Speaker after speaker invoked the mode of dress as symbolising the message of the Mahatma. Why did we all not follow his example and give up everything to thus mingle more definitively with the masses?

Then, on the last evening of the conference, Dalit poet Devanur Mahadeva got up to speak. He read out a short poem in Kannada, written not by him but by a Dalit woman of his acquaintance. The poem spoke reverentially of the great Dalit leader B. R. Ambedkar (1889–1956) and, especially, of the dark blue suit that Ambedkar invariably wore in the last three decades of his life. “Why did the Dalit lady focus on Ambedkar’s suit?” asked Mahadeva. “Why, indeed, did the countless statues of Ambedkar put up in Dalit hamlets always have him clad in suit-and-tie?” he asked. His answer was deceptively and eloquently simple. Now if Gandhi wears a loin-cloth, said Mahadeva, we all marvel at his *tyaga* (Hindi for sacrifice). The scantiness of dress is, in this case, a marker of what the man has given up. A high-caste, well-born English educated lawyer had voluntarily chosen to give up power and position, and live the life of an Indian peasant. That is why we memorialise the loincloth.

However, if Ambedkar had worn a loincloth that would not occasion either wonder or surprise, “He is an Untouchable,” we would have said – what else should he have worn? Millions of his caste fellows wear nothing else. His extraordinary personal achievements – a law degree from Lincoln’s Inn, a PhD from Columbia University and the drafting of the Constitution of India – allowed him to escape the fate that society and history had allotted to him. The fact that he escaped his fate is so effectively symbolised in that blue suit. Modernity, not tradition, and development, not stagnation, are responsible for this inversion and this successful yet all-too-infrequent storming of the upper caste citadel.

Finally, it should be said that the aspirations for a better – or at least different – life among the disprivileged or disadvantaged are not restricted to economic elements alone. The journalist who visited Douglas Tompkins’s Chilean estate found that the folk musicians employed to preserve their music listened, on the sly, to American rap [30].

VI

Let me now attempt to represent the story of Ambedkar’s suit in more material terms. Consider these simple hierarchies of fuel, housing and transportation: Table 1.1.

Table 1.1 : Hierarchies of Resource Consumption.

Fuel Used	Mode of Housing	Mode of Transport
Grass	Cave	Feet
Wood, Dung	Thatched hut	Bullock cart
Coal, Kerosene	Wooden house	Bicycle
Gas	Stone House	Motor scooter
Electricity	Cement House	Car

To go down any of these lists is to move towards a more reliable, more efficient and generally safer mode of consumption. Why then would one abjure cheap and safe cooking fuel, for example, or quick and reliable transport or stable houses that can outlive one monsoon? To prefer gas to dung for your stove, a car to a bullock-cart for your mobility or wood home to a straw hut for your family is to move towards more comfort, well-being and freedom. These are choices that, despite specious talk of cultural differences, must be made available to all humans.

At the same time, to move down these lists is to move towards a more intensive and possibly unsustainable use of resources – unsustainable at the global level, that is, for while a car expands freedom, there is no possibility whatsoever of every human on earth being able to possess a car. As things stand, some people consume too much while other people consume far too little. There is an intimate, though not often enough noticed, overlap between ‘ecological entitlement’ and ‘economic status’. For not only do the rich and powerful consume more than their ‘fair share’ of the world’s resources, they are also usually better protected from the consequences of environmental degradation. It is these asymmetries that a responsible politics would seek to address. Restricting ourselves to India, for instance, one would work towards enhancing the social power of ecological refugees and ecosystem people, their ability to govern their lives and to gain from the transformation of nature into artefact. This policy would simultaneously force omnivores to internalise the costs of their profligate behaviour. A new ‘green’ development strategy would have six central elements:

1. A move towards a genuinely participatory democracy with a strengthening of the institutions of local governance (at village, town or district levels) mandated by the Constitution of India but aborted by successive Central Governments in New Delhi. The experience of the odd states, such as West Bengal

and Karnataka, which have experimented seriously with the *panchayat* or self-government system, suggests that local control is more conducive to the successful management of forests, water and other natural resources.

2. Creation of a process of natural resource use that is open, accessible and accountable. This would centre around a properly implemented Freedom of Information Act, so that citizens are fully informed about the designs of the State and better able to challenge or welcome them, thus making public officials more responsive to their public.
3. Use of decentralisation to stop the widespread undervaluing of natural resources. Removing subsidies and using proper price tags will make resource use more efficient and less destructive of the environment.
4. Encouragement of a shift to private enterprise for producing goods and services while making sure that there are no hidden subsidies, and that firms properly internalise externalities. There is, at present, an unfortunate distaste for the market among Indian radicals, whether Gandhian or Marxist. But one cannot turn one's back on the market; the task rather is to tame it. The people and environment of India have already paid an enormous price for allowing state monopolies in sectors such as steel, energy, transport and communications.
5. The outlining of sustainable policies for specific resource sectors. Scientists and social scientists with the relevant expertise need to design sustainable policies for transport, energy, housing, health, forests, and water management. These policies must take account of what is not merely desirable, but also what is feasible.
6. This kind of development can, however, only succeed if India is a far more equitable society than it is at present. Three key ways in enhancing the social power of ecological refugees and ecosystem people (in all of which the Indian state has largely failed) are land reform, literacy – especially female literacy – and proper health care. These measures would also help bring population growth under control. In the provision of health and education the State might be aided by the voluntary sector, paid for by communities out of public funds.

The charter of sustainable development outlined here applies, of course, only to one country, albeit a large and probably fairly representative one. Its *raison d'être* is the persistent and grave inequalities of consumption within the nation. What then of

inequalities of consumption between nations? This question has been authoritatively addressed in a study of the prospects for a ‘Sustainable Germany’ sponsored by the Wuppertal Institute for Climate and Ecology [31]. Its fundamental premise is that the North lays excessive claim to the “environmental space” of the South. For the way the global economy is currently structured, “The North gains cheap access to cheap raw materials and hinders access to markets for processed products from those countries; it imposes a system (World Trade Organization) that favours the strong; it makes use of large areas of land in the South, tolerating soil degradation, damage to regional eco-systems, and disruption of local self-reliance; it exports toxic waste; it claims patent rights to utilization of biodiversity in tropical regions, etc.” [31]

Seen “against the backdrop of a divided world”, says the report, “the excessive use of nature and its resources in the North is a principal block to greater justice in the world... A retreat of the rich from overconsumption is thus a necessary first step towards allowing space for improvement of the lives of an increasing number of people”. The problem thus identified, the report goes on to itemise, in meticulous detail, how Germany can take the lead in reorienting its economy and society towards a more sustainable path. It begins with an extended treatment of overconsumption, excessive use of the global commons by the West over the past two hundred years, and the terrestrial consequences of profligate lifestyles – soil erosion, forest depletion, biodiversity loss, and air and water pollution. It then outlines a long-range plan for reducing the “throughput” of nature in the economy and cutting down on emissions.

Table 1.2 summarises the targets set by the Wuppertal Institute. The report also outlines the policy and technical changes required to achieve them. These include elimination of subsidies to chemical farming, levying of ecological taxes (on gasoline, for example) and moving towards slower and fuel-efficient cars while shifting the movement of goods from road to rail. The report identifies some concrete examples of resource conservation in practice, such as the replacement of concrete girders by those made with steel, innovative examples of water conservation and recycling within the city, and a novel contract between the Munich municipal authorities and organic farmers in the countryside. Building on examples such as these, Germany could transform itself from a nature-abusing society to a nature-saving one.

The Wuppertal Institute study is notable for its mix of moral ends with material means, as well as its judicious blending of economic and technical options. More striking still has been its reception. The original German book sold 40,000 copies, with an additional 100,000 copies of an abbreviated version. It was made into an award-winning television film, and discussed by trade unions, political parties, consumer groups, scholars, church congregations and countless lay citizens. In several

Table 1.2 : *Some Environmental Objectives for a Sustainable Germany.*

Environmental Indicator	Target set for the year 2010
Energy	
Energy consumption (overall)	at least –30%
Fossil fuels	–25%
Nuclear power	–100%
Renewables	+3 to 5% per year
Energy efficiency	+3 to 5% per year
Materials	
Non-renewable raw materials	–25%
Material productivity	+4 to 6% per year
Substance release	
Carbon Dioxide	–35%
Sulphur Dioxide	–80 to 90%
Nitrogen oxides	–80% by 2005
Ammonia	–80 to 90%
Volatile organic compounds	–80% by 2005
Synthetic nitrogen fertilizers	–100%
Agricultural biocides	–100%
Soil erosion	–80 to 90%
Land Use	
Agriculture	Extensive conversion to organic farming methods
Forestry	extensive conversion to ecologically adapted silviculture

Source: Wolfgang Sachs, Reinhard Loske and Manfred Linz *et al.*, *Greening the North: A Post-Industrial Blueprint for Ecology and Equity* (London: Zed Books, 1998)

German towns and regions attempts have begun to put some of these proposals to practice.

Admittedly, to reduce consumption even in a green-conscious, rich society like Germany will take great skill and dexterity. On the one hand, as the Wuppertal Institute has demonstrated that the affluent economies of the West might easily limit material consumption without a diminution in individual or social welfare. On the other hand, if the economy does not ‘grow’ at, say, 3% to 4% per annum, this will lead to unemployment. This is precisely what happened during the SPD–Green coalition of 1998–2005, leading to their removal from office in the German elections of 2005. Of course, one might still aim for a ‘steady-state economy’ and address the problem of unemployment by following policies of internal redistribution, but this could put place great strains on the welfare state.

That governments are compelled to pursue policies which are popular enough to win or retain office further complicates what is already a deeply complicated relationship. The social needs and demands of the economy have to be made consistent with the natural constraints of ecology; both have to be harmonised with the political imperatives of democracy.

To effectively and sustainably resolve these conflicts requires us to truly think through the environment: think through it morally and politically, historically and sociologically, and – not least – economically and technologically. The challenges that this poses are formidable indeed. Yet, they have to be met. The inequalities of consumption must be addressed at both national and international levels. And the two are interconnected. The Spanish economist Juan Martinez-Alier provides one telling example. In the poorer countries of Asia and Africa, firewood and animal dung are often the only source of cooking fuel. These are inefficient and polluting, and their collection involves much drudgery. The provision of oil or LPG for the cooking stoves of the Nigerian or Nepali peasant woman would greatly improve the quality of their lives. This could be done very easily, says Martinez-Alier, if one very moderately taxed the rich. He calculates that to replace the fuel used by the 3,000 million poor people in the world, we require about 200 millions of oil a year. This is less than a quarter of the United States’ annual consumption. But the bitter irony is that “oil at \$15 [or even \$50] a barrel is so cheap that it can be wasted by rich countries, but too expensive to be used as domestic fuel by the poor”. The solution is simple – namely, that oil consumption in rich countries should be taxed while the use of LPG or kerosene for fuel in poor countries should be subsidised [32]. Thus, to allow the poor to ascend but one step up the hierarchies of resource consumption requires a very moderate sacrifice by the rich. In the present climate, however, any proposal

with even the slightest hint of redistribution would be shot down as smacking of ‘socialism’. But this might change as (and when) conflicts over consumption begin to sharpen, as they assuredly shall. Within countries, access to water, land, forest and mineral resources will be fiercely fought over between contending groups. Between countries, there will be bitter arguments about the ‘environmental space’ occupied by the richer nations. As these divisions become more manifest, the global replicability of North Atlantic styles of living shall be more directly and persistently challenged. Sometime in the middle decades of the 21st century, John Kenneth Galbraith’s great unasked question, ‘How Much Should a Country Consume?’ – with its Gandhian corollary, ‘How Much Should a Person Consume?’ – will come, finally, to dominate the intellectual and political debates of the time.

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- [26] Patrick Symmes, *Chasing Che: A Motorcycle Journey in Search of the Guevara Legend* (New York: Vintage Books, 2000), 85-92.
- [27] See, for instance, Arturo Escobar, *Encountering Development: The Making and Unmaking of the Third World* (Princeton: Princeton University Press, 1995); James Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998); Wolfgang Sachs, editor, *The Development Dictionary: A Guide to Knowledge as Power* (London: Zed Books, 1992).
- [28] Rahnema, M. (1998). Editor, *The Post Development Reader*, London: Zed Books.
- [29] Williams, 'Culture is Ordinary', an essay of 1958 quoted in Christopher Hitchens, *Unacknowledged Legislation* (London: Verso, 2000), 30.
- [30] Symmes, *Chasing Che*, 93-4.
- [31] Sachs, W., Loske R. & Linz M. et al, *Greening the North: A Post-Industrial Blueprint for Ecology and Equity* (London: Zed Books, 1998), on which the rest of this section is based. Also see F. Schmidt-Beek, editor, *Carnoules Declaration: Factor 10 Club* (Wuppertal: WIKUE, 1994), which sets a target of 90% reduction in material use by the industrialized countries.
- [32] See his essay on 'Poverty and the Environment', in Guha and Martinez Alier, *Varieties of Environmentalism: Essays North and South* (London: Earthscan, 1997). Also Juan Martinez-Alier, *Ecological Economics: Energy, Environment, Society* (London: Basil Blackwell, 1987: revised edition, 1991).

2

GANDHIAN LEGACY OF DECENTRALISED, DISTRIBUTED AND CHALLENGE-DRIVEN INNOVATION CULTURE

IASc-DBT Gandhi Lecture: 13 February 2021

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The challenge awards may help in inducing inclusive innovations to address many wicked problems or persistent unmet social needs. I will first deal with the extraordinary legacy of the Gandhian innovation challenge award to address persistent unmet needs through crowd sourcing and open innovation contest. I think there is a great opportunity for all of us to continue that legacy which we have not yet incorporated in our science, technology, and innovation policies. But I hope that the new policy draft that is being discussed will incorporate it. I will then discuss other lessons that follow from the application of Gandhian principles to creating an inclusive grassroots innovation ecosystem.

YouTube lecture link: <https://www.youtube.com/watch?v=wE2G3JdN5UA>



Figure 2.1 : *Thol Lake, Gujarat. Source: Dr Anamika Dey.*

The first principle of innovation is apparent in the picture of the ducks (*Figure 2.1*). While four ducks are moving in one direction, there is a lone duck breaking the trend, moving in the opposite direction. And this ability to differ, dissent and not follow the popular or traditional path lies at the core of Gandhian spirit of democracy, decentralisation and distributed development. He was a great believer in sticking his neck out on matters that he strongly believed in, without caring whether others would approve or not. And sometimes, he found himself in great controversy. His statement during the time of the severe earthquake in Bihar in 1934 that linked the calamity with the so-called accumulated social sin of untouchability was devoid of any scientific or rational belief. When Tagore accused Gandhi of his “unscientific view of things”, Gandhi wrote in *The Harijan*¹ “though they seem to have only physical origins, (these) are, for me, somehow connected with man’s morals. Therefore, I instinctively felt that the earthquake was a visitation for the sin of untouchability”.

This apart, Gandhi was a great learner and always highlighted the value of self-critical learning. He would often say not go by what he said yesterday but to believe in what he was saying today. He would have no hesitation in contradicting him-

self, thereby letting his ideas evolve. He admired scientific inquiry, liked the risk scientists took to understand natural phenomenon more deeply and tried to address unmet social needs. He was thus not against the spirit of science. It is only when science became too focussed on materialistic achievements rather than spiritual or social achievements that he felt concerned or worried. He showed sensitivity to the role of intellectual property, global crowd sourcing of innovative solutions, and defining boundary conditions of the proposed solution embedding extreme affordability, frugality and sustainability. He was so much ahead of his time.

The central thesis that I am going to propose is how challenge awards can help overcome inertia in inducing inclusive innovations: How do we create a web of social and ethical capital? Why have we failed to maintain the legacy of such a pioneering process of seeking and spreading solutions? I will also explain how the social movement triggered by the Honey Bee Network has tried to close some of these gaps.

LEVERAGING SOCIAL AND ETHICAL CAPITAL

Social capital includes trust, reciprocity, and third party sanctions, and in ethical capital, the sanctions are internal. We punish ourselves by not rising to the standards or values we set for ourselves. In ethical capital, *internal commands* replace *external demands*: I do the things that I need to do, not because somebody else wants me to do. Both social and ethical capitals are very important drivers of what Gandhi often did. Let's look at a story of a Gandhian hack:

A GANDHIAN HACK: SOLVING WICKED PROBLEMS THROUGH CHALLENGE AWARDS

Gandhi pursued an experiment to find whether continuance of traditional technology as such would perpetuate poverty. In 1916, when he learnt from Vinoba Bhave that a worker could earn only 2 annas (1 rupee had 16 annas) by working efficiently for the full day on the traditional spinning wheel, the Charkha, Gandhi realized that this was not enough to take a person out of poverty. He then decided in 1920 to have a national innovation challenge, or competition, to improve the Charkha.

The source of his extreme dissatisfaction was inertia in changing the traditional design of Charkha which had remained the same for millennia. And he realised that if this design remained intact, then poverty could never be eliminated because the productivity was too low. Even if one paid for the labour fairly, still the worker would not earn enough to make his or her living.

Maganlal Gandhi, the technology lab-in-charge at the Ashram, announced on February 25, 1920, in *Young India*, the journal through which Gandhi shared his ideas and sought feedback (1919–1931):

“To the inventors of improved spinning wheel. The time for sending the (new) machine expires on the 31st March next. Mr. Gandhi will be the judge and he will be helped by experts. The amount of the prize is Rs. 5,000.”

He received a number of machines, but none of them satisfied all the criteria cited. Gandhi was frustrated. He extended the time, but it still didn’t work. In April issue of *Young India*, he announced that the criteria for the award were revised: Gandhi wanted not twice but five times more productivity than the common Charkha.

The ashram received six ideas from Baroda, Sialkot, and other parts of the country. But none met the criteria.² Two shortlisted inventors were given extra time to revise their designs and come up with modified designs. The problem still did not get solved. Though frustrated, Gandhi did not give up: he announced a global innovation challenge on July 24, 1929 (*Figure 2.2*).

The announcement (*Figure 2.2*) provides a glimpse of his foresight and precision in defining the boundary conditions. He made several points through this announcement:

**Mahatma Gandhi’s Announcement of a Design Competition,
24th July 1929 One Lakh Rupees or 7700 Pounds Prize!**

Akhila Bharatiya Charkhaa Sangh Worker’s Samiti has decided to organize this contest for inventors and engineers all over the world that if they could come up with a Charkha or a Samyukta Yantra which - for making the thread and cloth that satisfies the following criterion - shall be awarded prize money of 1 Lakh Rupees or 7700 pounds.

The Criteria

- Charkha must be light-weighted, easy to move, and it should be in such a way so as to be operated using either hand or one’s leg in a natural way in the rural cottages of India.
- It must be in such a way that a lady shall be able to work with it for eight hours at a stretch without great effort put in.

(*Figure 2.2 continued. . .*)

- Either Charkhas must have a build to accommodate the use of a puni (used to make handspun cloth) or along with the charkha there must be a way to handspun cloth.
- On working with the charkha for eight hours at a continuous stretch - it should result in 12 to 20 numbers of 16000 feet yarn.
- The machine should be so designed such that it costs no more than Rs. 150 in producing it in India only.
- The machine should be strong and well-made and with time-to-time servicing it should be capable of running for at least 20 years without any stopping. Servicing of the machine should not cost much and every year not more than 5% of the cost of the machine that year shall be needed for servicing.
- All those taking part in this contest may, with their own input costs and expenses, send their machines to Sabarmati Ashram before or not later than 30th October, 1930. In case the machines satisfy the criterion mentioned - then the inventor/designer can patent it on his name to protect their rights on them. But, if they wish to become eligible to win the prize money of the contest, then the designer shall have to transfer the rights of the patent to Indian Charkha Sangh Council.
- The Judges for the Contest shall be Khadi Pratishtan's Sri Satish Chandra Das Gupta, Bardoli Swarajya Ashram's Technical Director Sri Lakshmidas Purushottam and Tiruchengondur Gandhi Ashram's Director Sri Chakravarthy Rajagopalachari. In case there is no consensus amongst the judges on the winner - Gandhiji's decision shall be the final one. In case of Gandhiji's absence Akhil Bharat Charkha Sangh Mantri Sri Shankar Laal Banker shall be the final decision-maker.

All questions and queries may be addressed to Mantri, Akhil Bharat Charkha Sangh, Mirzapur, and Ahmedabad.

Figure 2.2 : Mahatma Gandhi's announcement of a design competition, 1929 (<https://gyti.techpedia.in/announcement>).

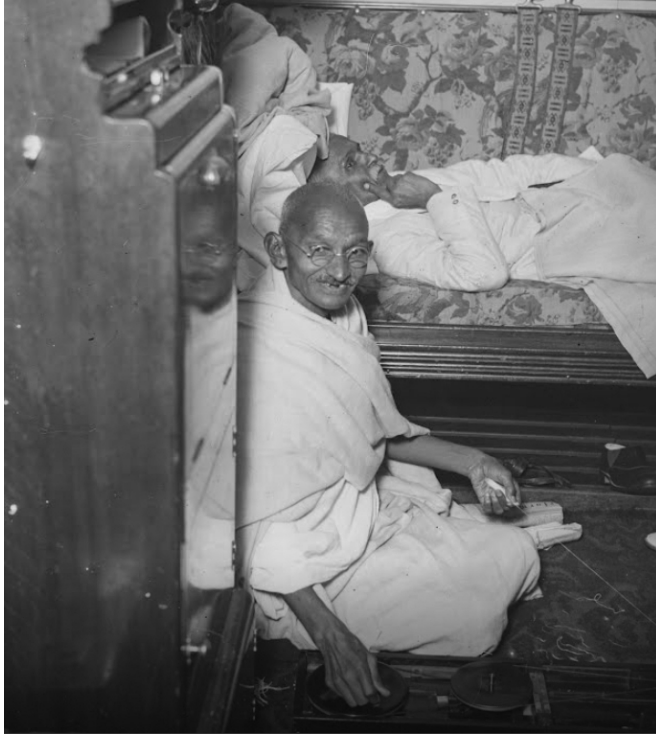
If there is a problem that we are not able to solve within our own means and, for that matter, within the national boundaries, do we reconcile with the inertia? Do we wait until an Indian finds a solution? He opened the competition to the whole world. And interestingly, he mentions toward the end of this announcement that one could file a patent if one wished. But if the winner wanted the award money, he/she would have to transfer the patent right to the Khadi Prayog Samiti to make it open source.

The father of open innovation and crowdsourcing, Gandhi, designed a challenge award for meeting a public purpose through an open free-to-use solution. Of course, there were challenge awards way back in the 16th/17th century in Europe.³ But, Gandhi was a pioneer in using challenge awards for solving social problems during the colonial era. He was very keen that the committee should comprise experts of extraordinary nature. If they were unable to reach a consensus, his judgement would be final – that was Gandhi. As the story goes, box or peti Charkha is one of the derivative innovations that emerged from that process. Gandhi had apparently modified the Peti Charkha and used it in 1931 in Yarovada jail, where he was arrested for protests against the colonial rule. It was foldable, very light and portable, worked very well, and was easy to fix, use and maintain. It met the various conditions that he had put forward in the competition (*Figure 2.3*).

Having looked at the Gandhian hack which demonstrates how wicked problems have to be benchmarked and solved, the question is, what prevents our scientific and technological community and, for that matter, public-policy makers from solving social problems by announcing attractive challenge awards?

CULTURE OF INERTIA: WHEN WILL WE OVERCOME

The first example is of paddy: We know that almost 85 to 90 per cent of paddy is transplanted by women. They work for weeks in a back bending posture with their feet in water. They get ulcers on their feet and pain in their backs, and yet we do not have very good manual paddy transplanters. The Honey Bee Network has come up with a few designs, but these are either not efficient enough or have not diffused enough. For the mat-based nurseries, there are devices, even motorized ones, but that's a very small share of the total paddy cultivation. Recently, Grassroots Innovations Augmentation Network (GIAN) invested in a manual paddy transplanter designed by Nishi Bishwas, Bhopal, MP, under MVIF (Micro Venture Innovation Fund), which is somewhat better than the earlier ones. But, we must recognise that such a serious problem affecting millions of women has remained off the radar of formal R&D institutions for so long.



It is believed that Gandhi devised a nifty, portable spinning wheel - the peti charkha - in 1930 during his time in Poona's Yervada Jail after his initiation of a Civil Disobedience Movement. (Gandhi Weaving (Sept 12, 1931) by Miller, Getty Images)

Figure 2.3 : Gandhi weaving, 1931. Source: <https://artsandculture.google.com/exhibit/charkha-the-device-that-charged-india-s-freedom-movement-mode/AQICNSJPMyVJg?hl=en>

The second example is of tea: Many of us begin our day with a cup of tea, but most of us don't realise the drudgery the tea garden labourers, mostly women, go through: she picks leaves thousands of times, bending forward with the weight of the basket on the back, which causes pain in the back, arms and neck.⁴ We obviously don't experience this pain when we have a cup of tea – a reflection on our *samvedana*, or lack of it.

One of the reasons why inertia may persist is lack of *samvedana*, or empathy. *Samvedana* is a beautiful Sanskrit word used in many Indian languages as well: *sam* means equal and *vedana* means pain. When we feel somebody else's pain as intensely as them, it doesn't remain that person's pain – it becomes ours. When I try to solve a problem with a feeling of *swantah sukhaya*, i.e. for my own happiness, transition takes place from *samvedana* to *srijansheelta*, i.e. creative solution.

The issue, of course, is why are we not more impatient with inertia. There are many more examples: The open wood stove/chulha is very common. It has hardly 15–20 per cent combustion efficiency. Designed maybe 10000 years ago, millions of women still use it every day without much improvement.

Similarly, almost every house in the Northeast has a handloom. This handloom is spread on the ground, tied to a tree or a wall, can be set up in the house, and can be used anywhere. This has cultural significance in some parts: When a man proposes to a lady, he will go and appreciate the weaving that she was busy with.

This loom technology has not undergone a great change. For the traditional jacquard loom, Deepak Bharali, Assam, developed a magnetic bobbin, which reduced thread wastage and improved productivity. He was supported by the Honey Bee Network (HBN), National Innovation Foundation (NIF), and some faculty of Indian Institute of Technology, Gandhinagar (IITG). For muga silk, Dulal Chaudhary developed a method to produce softer Ahimsa silk. Both these innovations have diffused locally but not very widely. Magha Yambem,⁵ Manipur, recently motorised a traditional loom and improved the productivity significantly. There is not enough public policy support to add value to these innovations and, after large-scale multi-location trails, diffuse them widely. This is one of the major ironies of our time.

If Gandhian ethos had been followed, then we would identify the challenges of unmet technological needs in each state or district and offer challenge awards appropriately at different scales and levels including global ones. We would identify, for example, the fact that we don't have a nut cracker for Mahua, a kind of lifeline of tribals in the forest. They have been using the same stone that they used 10,000 years ago to crack the nut.

Is it not ironical that despite numerous technological achievements of which any country can be justifiably proud of, not even one gram of forest produce is valorised, so to say, in the forest itself. Unless *in situ* value addition takes place through extremely affordable technologies, poverty of tribal communities will not go away easily. The science, technology and innovation ecosystem has to prioritise plans to address persistent/wicked unmet social needs.

HOW TO DESIGN FUTURISTIC STI POLICY? LEARNING FROM SHODHYATRAS

Grassroots innovators have been trying to solve local problems through their own genius. They are impatient. Thankfully, there are people in this country and, for that matter, around the world who are very impatient with inertia, and that's what leads

to this kind of innovations. While moving towards a common frugal future, we have to capture the essence of how these ideas emerged. There are unmet needs – they could be accidental or episodic, as in the case of climate emergencies. The unmet needs could also be the outcome of the inability of local communities to solve many problems until someone (often individual but sometimes a group) takes it up and starts trying to tackle it. There may be inertia because of scale, limited scope, limited resources, one's own inability to imagine, lack of relevant skills, lack of exposure to contrasting ideas, or lack of training/education, and sometimes diffidence, what is called in psychology, 'learned helplessness'. Many who are impatient with the inertia are empathetic, *samvedansheel*; they have less hesitation in solving problems and are able to convert their own or community suffering/samvedana into a social good. They may or may not be supported by their families or communities. Some of these outliers are even made the butt of jokes. Some innovations emerge out of a concern for sustainability, inclusivity and, of course, continuous improvement in the current solution through a series of incremental innovations.

One of the most persistent concerns of Gandhi was about inclusivity, or Antodaya, putting the last first. When he read the book by Ruskin,⁶ he was so deeply inspired that he translated it in Gujarati and evolved the idea of 'Sarvodaya through Antyodaya' and incorporated it into his own philosophy. He was a great assimilator – he had no qualms in learning from anywhere. And that's an approach which makes science flourish; in that sense, he was very scientific. He would look up good ideas, incorporate them into his thinking, and experiment with them, and if he found them valid, then in his own ways, he would adopt these and propagate them. His autobiography itself was called *My Experiments with Truth*. We can bridge the social gap through new innovations, or repurposing, redesigning, recalibrating, rejuvenating solutions for institutional and technological transformation. An inclusive ecosystem may then evolve.

The journey for creating an inclusive innovation ecosystem started with seeding Honey Bee Network (HBN) in 1988-89.^{7,8} To provide institutional support to an informal new social movement, SRISTI was set up in 1993 and GIAN in 1997 as the first grassroots innovation incubator, perhaps in the world, with the help of Indian Institute of Management, Ahmedabad (IIMA), the Gujarat Government, and HBN. To scale up GIAN's model, the National Innovation Foundation was set up in 2000 with the support of HBN, and the Ministry of Finance and Science and Technology. The Shodhyatras were started to reinforce collective learning, intelligence and wisdom by sharing and seeking grassroots innovations and traditional knowledge, institutions and creative ideas. We have walked through every state, many states more than once,



Figure 2.4 : Shodhyatra.

from Andaman to Gurez Valley, J &K, Dhemaji and Arunachal Pradesh to Rajasthan, Kutch and Koraput.

During Shodhyatra (*Figure 2.4*) – our learning, sharing and discovery walks through each state of the country, we learned a lot about how common people create institutions, technological solutions and cultural platforms that trigger the search for sustainable resource-use practices. We try to learn from four teachers in each walk: a teacher within, a teacher around us i.e. among peers, a teacher in nature and a teacher among common people. There has been no Shodhyatra in which we did not find a creative person or community.

During the Shodhyatra in Arunachal Pradesh, we met Lyagi Baht, who had designed a machine to flatten bamboo to make roofs or walls, a task which is mostly done by hand. He worked in a local office and thus needed help from institutions designed to help such salaried or service people. Such institutions did not reach him. At that time, NIF worked with only the informal or unorganised sector since their problems were even more difficult to address. No mechanical engineer or no professor of mechanical engineering has worked with him to make the machine even more efficient. He lost interest because productivity was low, but he did take an initiative

without any formal training. He broke the inertia. How do we put such abandoned tech dreams on the table of academies/academics?

Every innovator is a kind of dissenter – a dissenter with inertia, with the status quo. In that sense, HBN is a network of oddballs: we have been looking for crazy people, people who don't accept the status quo as a limit on imagination. We have been trying to find local solutions, both contemporary, but also born out of traditional knowledge. In summer, we go to hot places; in winter, we go to cold places; in autumn, we go with our students at IIMA to the Himalayas. Once we were in a valley in Ladakh, accessible only by walking across a particular pass. We asked local community members that if there were an injury or an accident, what would they do? A shepherd opened a small box and showed us a layer of collagen⁹ that he had extracted from slaughtered animals. Those who work on protein chemistry would obviously know much more than I do on the properties of collagen and how it can heal.

Another example follows of how such knowledge is uncovered when we go on our walks. This distributed knowledge system is of great importance and it should engage scientists not only for doing good to the people but for flourishing science.

In our modern urban kitchens, we have no way to capture the heat energy in the flue gases released into the atmosphere. In *Figure 2.5*, we can see that there are four shelves in a Meghalaya kitchen. The wooden rods are cured by heating on the first shelf. These become stronger and are used in transportation trolleys. The second shelf has fuelwood being dried. In Cherrapunji, where world's highest rainfall takes place, one needs to dry fuelwood before use. The third shelf has cheese and meat dried for storage. And, of course, there is a seed bag on the top (not visible in the picture), in which stored seeds are fumigated for keeping pest away. The temperature gradient is being functionally utilised. Can we have more efficient way of waste heat utilisation in any system? Similar designs exist in Mizoram. During the Shodhyatra in Arku valley, Andhra Pradesh, we met Jyoti, who put the mature paddy panicles on the shelf above the cooking stove. The rate at which husk will expand is different than the rate at which rice grain inside will expand, and it becomes easier to thresh such paddy panicles. She used the waste heat to reduce the drudgery in threshing the paddy to separate grain from the chaff. This is how the Honey Bee Network scouts local experiments, innovations, and thus gives voice, visibility and velocity to the creative and innovative people in both formal and informal sectors.

It is in this context that we should avoid using language that distracts our attention from the resources in which poor people are rich. Many poor people are at the bottom or base of the economic pyramid. But they are not at the bottom of the knowledge,



Figure 2.5 : Multi-level energy harvesting arrangements in rural kitchens.

innovation or ethical pyramid. How can we start a process of rethinking, rejuvenating, redesigning, and recalibrating the scientific enterprise at least from the point of view of grassroots knowledge and grassroots innovators?

WHAT PEDAGOGICAL CLUE DID GANDHI PROVIDE IN THIS CONTEXT?

Once Gandhi was asked by a group of college students as to what should they do if they wanted to work in rural development. Gandhi said that since he had never worked in rural areas, he could not advise them. But, the students persisted as they thought Gandhi had an answer to every question. Which, Gandhi, sometimes joyfully and in a lighter vein, would also attempt to do! He said he would select an area, say a village, where he wanted to work and then he would select the domain in which he wanted to work such as dairy development. Next, he would find the family that

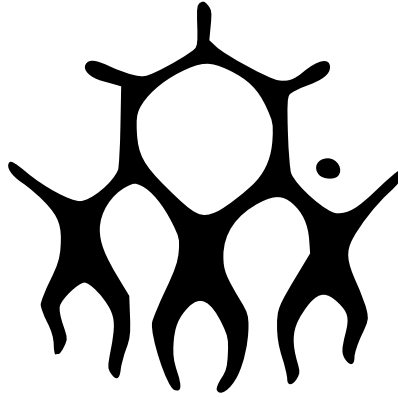


Figure 2.6 : *Honey Bee Network logo illustrating a nameless, faceless innovator who comes in contact with the Network and gets an identity.*

had the highest productivity and the cleanest barn in the village. He would observe how they took care of their milch cows from morning till evening and document all their practices. Then, he would do the same at the house of an average milk producer. Closing the gap between the two (the best and the average) would be his first plan of action. Around 80–90 years ago, Gandhi enunciated the best practice analysis approach. It might be interesting for us to look for the most efficient producers in different domains. In this process, we might find some local solutions or innovations that might have been missed in the past. Of course, we need to understand the science underlying the functional and viable community knowledge. I would wish that every Academy would devote at least 10 per cent of their time for 90 per cent of the poor.

ETHICAL PRINCIPLE GUIDING KNOWLEDGE EXCHANGE

The ground rules of such an interface between scientists and knowledge providers articulated by the Honey Bee Network (*Figure 2.6*) are as follows:

- a. Knowledge and data providers should not be anonymous – unless requested otherwise by them.
- b. The findings based on the knowledge or data collected from the people must be fed back to them in local language.

- c. Cross-pollination of ideas must enrich the local knowledge system: whatever research is done on their ideas must be shared with them in an easily comprehensible manner
- d. If any income or profit is generated from the commercialization of the knowledge or consultancies associated with it, this must be shared in a fair and just manner with the knowledge providers and their communities.
- e. All publications arising from such interactions must be joint publication. In majority of the cases handled by Honey Bee Network, the innovators/knowledge providers have been co-authors of the publications. Further, all the patents filed by SRISTI, GIAN and NIF have been in the name of the innovators/knowledge providers. It is true that a farmer, an artisan or a mechanic may not benefit much from the publication, but the scholars might feel good about themselves when they share credit.
- f. In situ value addition must be made possible with high-quality science.

Suggestions for action follow-up:

- a. Each Academy should prioritize the discussion and decision on long-term inertia about the unaddressed problems of the disadvantaged people, process and places and encourage members to address these through student projects, challenge awards or otherwise.
- b. The validation and value addition of functional and viable traditional knowledge should receive urgent attention both because of the rapid erosion of this knowledge and also because it may advance the frontiers of science in some cases. The example of spiders web for rapid blood coagulation used by workers, use of milk for viral disease control in several crops, use of navel route for delivering traditional drugs in infants, etc., just illustrate the potential of such knowledge systems.
- c. There are grassroots solutions/innovation which may not be optimized by the local innovators/communities for want of resources or adequate tools or due to just lack of adequate knowledge of alternative methods of solving problems. In such cases, validation and value addition is a very important function that institutional scientists can perform. It must be appreciated that almost all the scientists from CSIR, ICAR and ICMR labs who helped HBN and NIF in validating the people's knowledge did not charge for their own time. Some did not

charge even for consumables. This is a role that needs to be recognised and encouraged by various Academies.

- d. There is a need for challenge awards to be instituted at different levels in all the domains where interface with society takes place. This is an area where we have not had sufficient traction so far. Maybe the members can mobilise public and private sector support for getting such awards instituted for addressing serious wicked problems.
- e. The immersion of students from various disciplines in social realities is essential so that the Gandhian dream of decentralised, diversified and inclusive solutions can be developed to address the unmet social needs in an affordable and accessible manner.
- f. The Gandhian approach of action-research, experimentation, and overcoming the constraints of traditions while exploring solution to wicked problems needs more pervasive support.
- g. Incorporation of the stories of grassroots innovators and creative communities may be incorporated in the curriculum of undergraduate and post-graduate students of all disciplines so that their respect for grassroots knowledge and experimentation system increases.
- h. Longitudinal studies are extremely important to build models of complex interactions among various components of agro-ecosystems. There are very few studies in which data for 50–100 years has been collected to understand various interactions. The communities may have to be involved in monitoring the complexities from their perspective.
- i. The connection between soil and soul stressed by the Gandhian experimenters like K M Munshi needs to be scientifically advanced by linking soil, crop, animal and human health. A study pursued with the voluntary help of medical doctors and soil, animal and food scientists helped in mapping the contribution of soil minerals like copper in preventing chronic diseases among the studied volunteers. We need many more such studies to connect ecosystem health with our own health empirically to make us conserve the ecosystems.
- j. The connection between innovation, investment and enterprise at grassroots needs to be pursued through a grassroots-level innovation incubator like GIAN.

When we set up the GIAN in 1997, it was realised that given the transaction costs involved in accessing entrepreneurial partners and investment support by grassroots innovators, a mediating agency would be needed. The GIAN's golden triangle (*Figure 2.7*) 25 years ago underlined the need for such a platform that connected three vectors of the value chain. Maybe we need a global

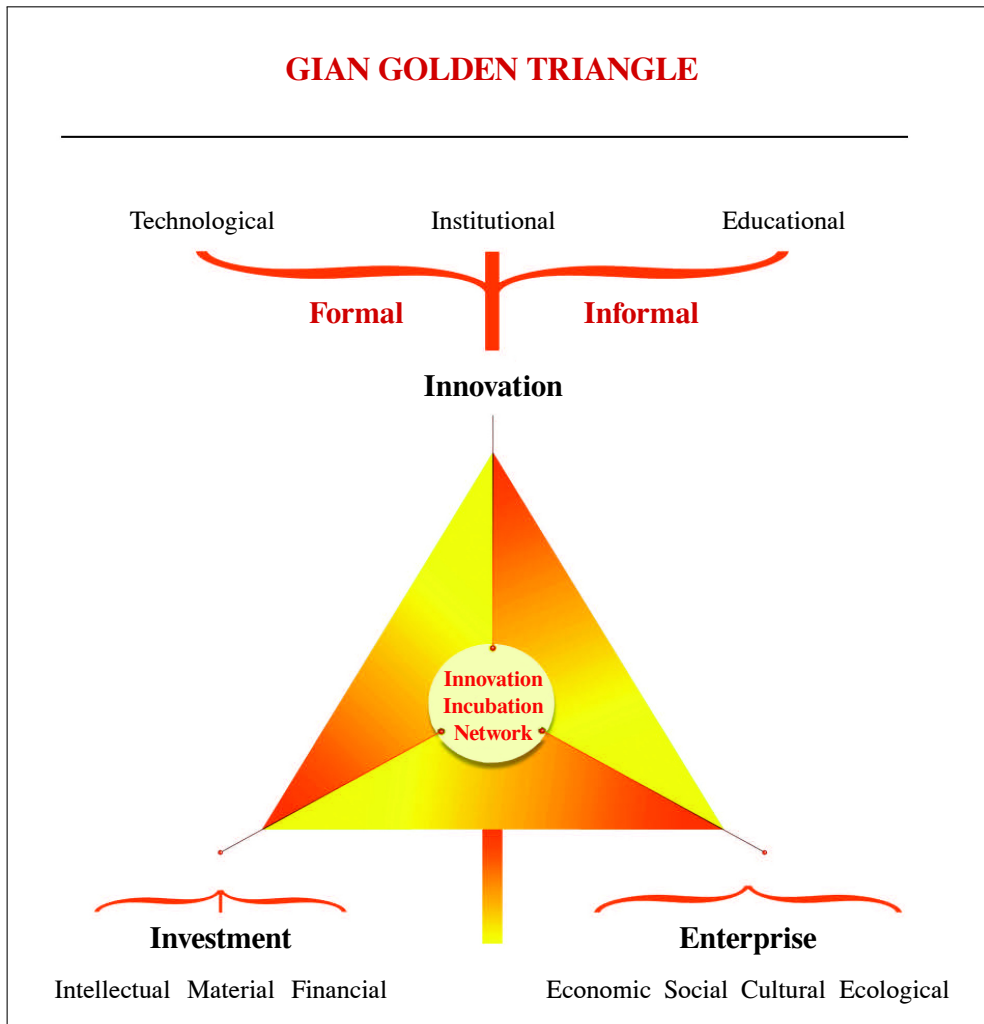


Figure 2.7 : The GIAN's golden triangle.

GIAN to provide similar support to grassroots innovators around the world. A Gandhian approach will require models to be developed which embrace entire humanity.

- k. Green grassroots innovations signify a strong decentralised and distributed approach by creative individuals and communities requiring a matching polity of a decentralised support system.
- l. Open databases (where possible in multiple languages and in multimedia) is another way of inclusiveness. Open-source databases like techpedia.in, developed by the Network, has more than 200,000 engineering projects pursued by over 550k students of technology. Another database (gian.org/patent.php or techpedia.in/patent) has 0.9 million abandoned U.S. patents for free use pooled by two of my former students Zaigam khan and Devika Kaushal for wider use freely. Similarly, sristi.org/wsa and honeybee.org have many open-access databases on common property resources, traditional knowledge, grassroots innovations and medicinal plants, etc. Without such databases, we cannot ensure true inclusiveness in science and technology pursuits.
- m. The Gandhian Antyodaya model remains the best bet for inclusive policy adaptation in almost every sector. Putting the last first was his credo. How else can we explain that, during COVID19-induced closure of schools, more than 50 per cent children in government schools were excluded from online education because their parents did not have smart phones and/or access to internet. Bala Jhadav did try to use the conference call feature of smart phones to bring 10 children at a time in a single call and thus included the whole class in 3–4 calls. Ashok Bhai and his team used the cable TV network to extend education. Both, government school teachers, were honoured with the HBNCRIIA Global Innovation Award by the Honey Bee Network and GIAN. If each Academy helps in putting the unaddressed technological challenges of bypassed spaces, sectors and social groups on the scientific and technological agenda, we will have paid a true tribute to the Gandhian legacy of inclusiveness, compassion, creativity and collaboration. *Samvedana* will thus trigger *srijansheelta*.

NOTES

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3

THE SCIENCE UNDERLYING GANDHI'S METHODS

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Let us start at the editorial office of *TIME* magazine in New York. It is December 1999, the end of the 20th century. *TIME* magazine wants to select the 'Person of the Century'. A large number of names have been suggested and the popular choice boils down to two names, Albert Einstein and Mahatma Gandhi. The editors have a dilemma and finally they select Einstein as the person of the 20th century. Science and a scientist triumphed over Gandhi, but in popularity. That was a judgement made in the 20th century. Now, in the 21st century, we need to re-examine the relationship between science and Gandhi, and come to our own judgement. That's what I'm going to attempt in this lecture. I am not at all going to talk about the work that I do because this particular topic is more fascinating than talking about my own work.

I have framed six questions for this exploration:

1. Was Gandhi anti-science?
2. How did he relate with science?

YouTube lecture link: <https://www.youtube.com/watch?v=t0q9w7B9608>

3. How was he different?
4. What was the science underlying his non-violence?
5. What was Gandhi's non-material method of knowing truth?
6. How is Gandhi relevant in the 21st century? Relevant to us?

I shall start with the allegation that Gandhi was anti-science, and then explore his relationship with science, his methods and how he is relevant to us today, if at all.

I must begin with a confession. I was born in a Gandhian family and grew up in Mahatma Gandhi's ashram. I studied in the school that Gandhi himself had started. At the age of 18, I started studying medicine, followed by public health, and for the past 35 years I'm carrying out medical and public health research. For nearly 50 years, since I was first introduced to science, I have had a chequered relationship with Gandhi on the question of science. I have felt embarrassed by his views; I have felt confused and angry. I have mentally had a series of arguments with him on the issue of science. I have had disagreements with him. And I'm happy to tell you that every single time, I have lost and he has won! In this lecture, I will share with you these 50 years of struggle to explore Gandhi and science. I must also acknowledge that I will heavily draw upon what Mahatma Gandhi has written and from his life, several biographers who have written beautifully about him, and his foremost disciple and exponent of his thoughts – Vinoba Bhave. I shall liberally make use of a beautiful article that Shambu Prasad wrote in *Economic and Political Weekly* nearly 20 years ago, and finally, my own experiences in life.

WAS GANDHI ANTI-SCIENCE?

People who were close to Gandhi, like Jawaharlal Nehru and Rabindranath Tagore, and people in the West, like Aldous Huxley, accused Gandhi of being anti-science. The architect of India's national science policy, Dr. Meghnad Saha, said this about Gandhi: "We do not for a moment believe that better and happier conditions could be created by discarding modern scientific technique and reverting back to the spinning wheel, the loin cloth and the bullock cart" [1].

The last part of his sentence is definitely aimed at Gandhi, and his techniques and symbols like the spinning wheel, loincloth and bullock cart. Saha, Nehru and the intellectual class of India as a whole believed that Gandhi was anti-science, and hence, is largely irrelevant today. Gandhi himself was, at least partly, responsible for this

impression. In *Hind Swaraj*, probably his most seminal book after his autobiography, he severely criticises what we consider science. But, be careful before drawing conclusions: he did not criticise science but some of the products of science such as machines and the medical practice. So, to us, he appears to be anti-science. Then, there was his faith in prayer and the *Ram nam*. Thus, for any person of science or anyone who considers himself/herself an intellectual, Gandhi is an anti-thesis. Hence, we have conveniently labelled him as an anti-science person. But then look at what he has to say about scientists. In his inaugural lecture at Tibbia College, New Delhi, in 1921, he said: "But, I have nothing but praise for the zeal, industry and sacrifice that have animated the modern scientists in the pursuit after truth" [2].

He highly appreciates the scientific spirit and the scientific inquiry. We need to look at his life for evidence of this. He said, 'my life is my message'. So, for a genuine inquiry, we must go beyond his statements, and look at how he lived and what he actually did. And if we go into that, we will find a lifelong curiosity and inquiry about the various issues of science – health, diet, sanitation, germs and exercise. He wanted to know the chemical analysis of various kinds of foods. His photograph with the microscope is well-known: he was trying to see the leprosy bacillus, the causative organism of leprosy. After 1942, when he was in Yerwada jail, he took a fascination to the telescope and developed the hobby of watching the sky. Gandhi made liberal use of scientific tools and methods. They are external, visible, but the more important is his attitude.

If we look carefully at Gandhi's attitude – his willingness to test, experiment and look for evidence; his willingness to correct himself and change – he had the attributes of a scientist. Gandhi said, "If a reader finds that my two statements contradict, take the later one as my better judgement". Political leaders or saints usually don't admit that their earlier statement was wrong and that their newer statement is their new judgement. They take pride in never changing. Gandhi, in this respect, was very much like a scientist. It is as if he was saying, "I change" or "As the new evidence comes, I change my views". Economist John Maynard Keynes was once confronted by a politician about what he had said earlier being different. Keynes responded, "Yes sir, if the facts change, I change my opinion. What else do you do?"

In this respect, Gandhi is very much like a scientist. The most powerful evidence of this comes from the incident of Chauri Chaura. We recently celebrated one-hundred years of the incident but the Government celebrated it for the wrong reasons. Gandhi had launched a national non-cooperation movement in 1920 with the belief that India was ready for a non-violent national movement. But in 1922, a mob in

Uttar Pradesh burned down the police station in Chauri Chaura, killing 22 policemen. Gandhi was shocked. He said, and he said it publicly, that he made a ‘Himalayan blunder’, his judgment that Indian people were ready for non-violent movement was wrong. This is akin to a scientist saying, “I had a hypothesis. It is refuted by the evidence. I accept it. And since my hypothesis was wrong, I must give it up and correct myself”. Therefore, he withdrew the entire national movement. That was one of the riskiest moments in Gandhi’s public life. He was just established as a national leader in India. And he risked that position by taking back the national movement, against the opinion of the entire country.

These are attributes of a scientist. Not only was the nation his laboratory, he himself was his laboratory. His experiments with Brahmacharya are famous as well as infamous but then he was experimenting on himself. “Is there any trace of sexual feeling left in me, which I want to get rid of? If I am truly non-violent, if I’m truly a saint or the so-called Mahatma, I should be completely free from the sexual desires, from *Vasana*. Am I?” He did the most sensitive and risky experiment on himself to search in the recesses of his mind and his body. I know that Gandhi has often been severely misunderstood and criticised for this experiment, but when I read about it, I was reminded of a name in medical science – John Hunter. Hunter was a famous anatomist about 200 years ago. He did one bold experiment on himself to find out how syphilis was transmitted. He took an inoculum from the sore of a patient of syphilis, injected it onto his own penis and observed. Within a few weeks, a syphilitic ulcer developed at the site, proving how the sexually transmitted disease spreads. Gandhi’s experiment on himself was as daring and risky as Hunter’s. And he wrote publicly about it. It’s no wonder that Gandhi titled his autobiography, *My Experiments with Truth*. His ultimate goal was to understand truth. These are all attributes of a scientist. He was a scientist of life.

HOW DID GANDHI RELATE WITH SCIENCE?

Now, we come to the next question. If Gandhi was not anti-science, how did he use, and relate with, science? We can see evidence of Gandhi’s relationship with – and application of – science in what Gandhi called ‘constructive programme’, the various programs of rural development and social reforms he started. Foremost amongst the constructive programs were khadi (hand-made cloth) and charkha (spinning wheel). Gandhi used scientific methods and looked for better technical tools to improve khadi so that the ordinary village spinner and weaver could produce better cloth, get more wages and people could use more khadi. He even coined the term ‘khadi science’.

He called charkha, the spinning wheel, a grand and noble machine. It is difficult to believe today but about 80 years ago, Gandhi announced an award of rupees one lakh at that time (probably worth rupees 10 crore today) for somebody to innovate a more efficient charkha. One finds that Gandhi used science liberally. He expected an attitude of a scientist from his khadi workers. He said, "The science of Khadi requires technical and mechanical skill of a high order and demands as much concentration as is given by Sir J. C. Bose to the tiny leaves of plants in his laboratory before he wrests from them the secrets of nature held by these fellow creatures of ours" [3].

He also said, "Under my scheme, there would be more and better libraries, laboratories, and research institutes. Under it, we should have an army of chemists, engineers and other experts who will be real servants of the nation and answer the varied and growing requirements of a people. The knowledge gained by them will be the common property of the people" [4].

The last sentence of this is the most relevant. What he said about knowledge gained by scientists being the common property of people is different from the intellectual property rights and patents we have now and the prevalent practice of knowledge being owned by scientists. Gandhi's purpose of science, purpose of research, and ownership of knowledge produced are different. He wanted that his ashrams should become laboratories of village and social reconstruction. He established the All India Village Industries Association for encouraging gramodyog (village industries). Three names would be very familiar to you – Sir C. V. Raman, Jagdish Chandra Bose and P. C. Ray, the three best scientists of India at that time. Gandhi invited them to work on his village industries' advisory board.

Finally, he coined the term 'Satyagrahi Scientist', which is so meaningful. What did Gandhi mean when he said that his ideal constructive worker, freedom movement worker, political worker or ashram inmate should be a satyagrahi scientist? He meant that the worker should be a satyagrahi – a non-violent seeker of truth. At the same time, he should also be a scientist in his attitude, methods and experimentation. That was Gandhi's vision. His choice of the first satyagrahi for the Vyaktigat Satyagrah (individual satyagrah) Movement in 1940 was very significant. He didn't select Jawaharlal Nehru as the first satyagrahi of the nation. Nehru came second. His first choice was Vinoba Bhave, who was an obscure person at the time. He selected Vinoba not only for his spiritual qualities but also for his scientific attitude. Vinoba had done phenomenal work on khadi and charkha.

A particular instance speaks volumes about Gandhi and his choice of Vinoba. The spinners of khadi complained to Mahatma Gandhi that their wages were very meagre. Economically, that was natural because khadi was not machine-manufactured;

it involved manual spinning and weaving. So, the rate of production was low. And the price of the cloth had to be kept low so that everybody would be able to purchase. Hence, the wages were low. When the labourers complained, Gandhi said that we cannot be unfair to the labourer. So, he invited Vinoba and asked him to suggest minimum wages for the khadi labourers. Vinoba asked for some time.

He returned after six months, a thinned person who had lost 30 pounds of weight. Gandhi was alarmed and when he asked him what had happened, Vinoba Bhave said, “For the past six months, I’m doing only occupation of spinning myself. And at the rate of the wages that we give to the spinner, I am able to earn two anas (one eighth of a rupee) per day. I have limited my food intake only to what can be bought with two anas. With the current wages, this is what happens”. Vinoba had turned himself into a laboratory.

To sum up, Gandhi liberally and enthusiastically welcomed and employed science, scientific methods and scientists in his constructive work – and constructive work was very important for him. He has said that in the last analysis, perfection in constructive work is Swaraj – freedom and the self rule.

HOW WAS GANDHI DIFFERENT FROM SCIENTISTS?

How was Gandhi different from a scientist? How was he different from us? Make no mistake, Gandhi was not great because he was scientific or because he used science. All scientists do that and that doesn’t make us Gandhi. Using science is commonplace. How was he different?

One, his yardstick to evaluate science was the purpose it was used for. Science had to have a meaningful purpose. Look at what he said: “I would like to pay my humble tribute to the spirit of research that fires the modern scientists. My quarrel is not against that spirit. My complaint is against the direction that the spirit has taken. It has chiefly concerned itself with the exploration of laws and methods conducing to the merely material advancement of its clientele” [5].

He praises scientists and the scientific spirit but he complains that they are using their skills and knowledge only for the material advancement of the clientele. For him, this was too narrow a purpose, too shallow a purpose. Science often becomes a tool either in the hands of those with capital, where it becomes a profit-making tool, or in the hands of the government, where it can become a tool of coercion and destruction. So, often, science and scientists end up making either the capitalists or the governments more powerful. In Gandhi’s hands, science becomes a tool for social change and justice. He believed that “Unless all the discoveries that you make have

the welfare of the poor as the end in view, all your workshops will be really no better than Satan's workshops" [6].

Ultimately, welfare of the people should be the end in view. Gandhi doesn't use mild words when he says that unless you do that, all your workshops will be no better than 'Satan's workshop'. He shakes us, hits us hard and forces us to examine what purpose our science, laboratories and scientific careers are being used for. Gandhi was great because in his hands, science became a tool of social change and justice.

Let us take the example of sanitation – cleaning of toilets. When Gandhi came to India in 1914, no person of higher class or higher varna ever even looked at his toilet. That was the dirtiest place in the house to be cleaned by the so-called dirtiest people in the society – the scavengers, the 'bhangi'. Gandhi introduced the practice of cleaning toilets in his ashram by doing it himself first. He made it a common practice. He applied science to cleaning toilets. In this way, he not only achieved sanitation and health but, more importantly, he began a major social reform – of getting rid of the caste distinction. He probably must be the first political leader to start cleaning his own toilet and made a public movement of it. Even when Jawaharlal Nehru, Rajendra Prasad and Vallabhbhai Patel came to his ashram, they had to clean their own toilets. In Gandhi's movement, even the Brahmins in Maharashtra – Vinoba Bhave, Bapat and Patwardhan – started cleaning toilets, not only their own but of others.

Appa Patwardhan, a gold medallist–graduate Brahmin from Maharashtra, joined Gandhi's movement and was jailed. The British did not give him the work of cleaning toilet because he was a Brahmin and in the jail's rulebook, Brahmins couldn't be given this kind of menial work. But Patwardhan said, I am Gandhi's soldier. It's one of the rules in my life that I clean my own toilet. You have to permit me a Bhangi's work. That is my freedom. The British Government refused. So, he went on a fast. Imagine a Brahmin going on fast over a bhangi's work. Finally, the British government had to relent. So Gandhi, through his work of cleaning toilets and sanitation, not only achieved 'Swachh Bharat', but he also transcended the varna barriers. That was revolutionary!

Gandhi was different in another way. He applied a moral test to science: "The advance of science has added not an inch to the moral stature of Europe. It has not reduced hatred and injustice" [7]. Here, he criticises European science for not reducing hatred and injustice. Gandhi expected science to reduce hatred and injustice, and to increase the moral stature of the population. He complained that science did not do these. At least at that time, science and scientists failed at that. We need to introspect how scientists perform now.

A test case of morality of science for Gandhi was vivisection – the dissection of living animals. It was considered necessary for the sake of knowledge of anatomy or zoology. During his adolescence, Gandhi wanted to become a doctor. One reason he didn't go for that career was that vivisection was necessary in medical training and his heart revolted against it. Gandhi opposed vivisection, even for the sake of gaining knowledge about the inside of animals, for two reasons: One was its effect on the animal – pain, suffering and death. The second was for its effect on the scientist performing the cruel act of dissecting and killing a live animal. Yes, they are merely animals – frogs, rabbits, monkeys or Guinea pigs – but the act of killing them, to Gandhi, was not that different from killing human beings. Gandhi didn't support vivisection, or rather, he actively opposed it, because it encouraged cruelty in the human heart, in the hearts of scientists.

Today, cruelty against animals is opposed globally. However, a hundred years ago people of science, like Nehru, Aldous Huxley and Meghnad Saha, laughed at Gandhi. “Oh, he is an anti-science man, doesn't want to dissect, doesn't approve of scientific inquiry!”, they might have said. Gandhi was not against dissection of dead bodies but he was definitely against the dissection of living animals. To him, this was a question of ethics, a moral test. To him, science could not be devoid of morality.

One more difference between us, the people of science, and Gandhi was that science by its very nature is reductionist. The scientist, with his tools of inquiry, focuses on one minute, part of the reality that he wants to study in depth. What happens then? It reminds me of a cartoon I saw in which a scientist is sitting in the gallery with a telescope. A comet is expected to rise somewhere in the sky. So the scientist has focused his telescope in that direction, at a particular angle, expecting to see the comet when it rises. He's waiting, keenly observing a narrow angle of sky through the telescope. His housemaid enters with a cup of tea and she looks at the open sky. She points out to somewhere else and says, “Oh, the comet!” The scientist misses it because he is focused very narrowly. The housemaid, on the other hand, might be illiterate but she sees the whole sky and hence the comet rising somewhere else.

Gandhi sees the whole sky. He sees the whole truth. He doesn't see only a narrow picture, a fragmented view of life. He looks at life as an integrated whole. Everything is connected with everything else. Take khadi that he promoted, for instance. Khadi provided market to the cotton of the farmer, gave wages to the spinner and the weaver, encouraged local production and consumption – that is *Swadeshi* – and supported the freedom movement. Khadi brought the people of upper class closer to the poor people. Gandhi had an integrated, holistic view of change. He achieved multiple outcomes in one stroke with khadi.

ISHAVASYAM IDAM SARVAM

Finally, one more difference between Gandhi and us, the people of science, is that for Gandhi nothing is jada – material, inanimate, dead. Everything in the universe is divine, permeated by the principle of life. Once, when Gandhi had gone to Allahabad, Nehru invited him over for dinner. After completing the meal, Nehru was pouring water on Gandhi's hands for cleaning. They were absorbed in talking about some national issue. Gandhi had completed washing his hands but Nehru, as he was looking at Gandhi's face, continued to pour water. Gandhiji said, "Jawahar, you are wasting water". Nehru jokingly said, "Bapu, this is Allahabad. The Ganga and Yamuna flow here. There's no dearth of water". Gandhi replied, "Yes Jawahar, Ganga and Yamuna do flow here, but they don't flow for your sake!" He was reminding Nehru that he had no right to waste even a drop of water just because it was only a material. Everything here was sacred to him. 'Ishavasyam idam sarvam', means everything here is permeated with the divine, with the truth principle. This view is different from our view. We look at everything as jada, an inanimate material. Gandhi looked at everything as material as well as sacred and divine.

Thus, Gandhi's greatness is located outside of science. It is located in his moral dimension. He summarises this moral dimension in two words – truth and non-violence. Shambu Prasad beautifully said, "Though a great believer in science, he was clear of its role in the cosmos, in this universe. Science to him was not above truth and non-violence. Truth and non-violence were truer than many so-called scientific facts" [8].

If it is so, while appreciating Gandhi for his use of science, we ought not to forget that Gandhi's uniqueness is not in science but it is in truth and non-violence.

GANDHI'S TRUTH AND ITS SCIENCE

Let us try to understand the science of his non-violence and the science of truth. What is the science underlying truth? Scientists and Gandhi have a common goal: they are seekers of truth. For Gandhi, truth was the ultimate goal of life. While earlier he used to say, "Truth is next to God", he then started saying, "Truth is like God" and, finally, Gandhi used to say, "Truth is God". What a statement! A religious person of faith said this, thereby implying that there is no other God. Truth is God. That was Gandhi's position about truth.

For exploring the material aspects of life, Gandhi used common scientific instruments such as the weighing scale, microscope and telescope. But for touching the moral or spiritual aspect of truth, Gandhi had some other method. What was that

method? He hinted about that method to the students of the Indian Institute of Science in Bangalore in 1929. He told them: “I tell you, you can devise a far greater wireless instrument, which does not require external research, but internal – and all research will be useless if it is not allied to internal research” [9].

He had some other instrument for this internal research. What was it? During one discussion with C Rajagopalachari, he said that he treated his mother, who was well-versed in the art of fasting, as a scientist. Why? “One who is pure, who adheres to truth, and wants to cling to it is as much a scientist as a physicist” [10]. The physicist is, of course, the most pure scientist, but then Gandhi is saying that his mother was close to that because she was pure. She fasted, she purified herself. Here we have a glimpse that Gandhi’s method to know the moral aspect of truth, the spiritual truth, was purifying the self. He had his Ekadash Vrata, the eleven rules of conduct, eleven vows. These were all for purifying the conduct, the heart and the life. Additionally, he used fasting as a method to purify himself, purify his heart. And finally, he had the prayer. Prayer is an acceptance that my strength has a limit, beyond which I cannot go any further. So finally I surrender, I pray to the symbol of truth, the *Ramanam*.

If you can get rid of your ego, and if your heart is clean and your life is clean, as Gandhi tried to make himself, in that pure and clean state of heart what appears in the mirror of your heart is the reflection of moral truth. Gandhi calls this “the inner voice”. When he took the decision of withdrawing the national movement because of the Chauri Chaura episode, he said, “My inner voice tells me that you were wrong. The whole world may go against me, but I’ll follow my inner voice”. That inner voice, to him, was like the message of God or the voice of conscience. Gandhi could connect with that through a particular method. It was not an accident. He had a method – your speech must be purified and it should be truthful, your behaviour should be non-violent, you should follow brahmacharya, and live a disciplined and restrained life. His method involved sharir-shram (physical labour), fasting, praying and submitting to God’s will. This is like cleaning your lenses and in that clean state, you get the vision of truth.

Of course, this is opaque to us. We don’t understand it; we know only the material methods of measurement and verification. We don’t want to take the efforts to clean our hearts. Why bother?! We clean our body but not our heart or conduct. And so we, the intellectuals and the scientists, conveniently labelled Gandhi as superstitious – one who talks about mystical things such as the inner voice. Because we cannot connect with our inner voice, we think nobody can. But Gandhi accessed moral truth and spiritual truth through these kind of processes.

THE SCIENCE OF NON-VIOLENCE

For Gandhi, non-violence was the path to know truth, to reach truth. You cannot be violent with truth, and force your wishes or ego on truth. For Gandhi – the scientist of life – non-violence was absolutely essential to reach truth, even in the political and worldly life. If that was so, what was the science underlying non-violence?

Today, we remember Gandhi for his non-violence, for his Satyagraha. His non-violence was very effective – against white people in South Africa, against the British in India, against communal riots in Calcutta. In the words of Lord Mountbatten, what an entire company of army couldn't do, this one frail old man could achieve – establish peace in Calcutta that was burning with communal fire. Gandhi was followed by Martin Luther King, eventually resulting in a black man, Obama, becoming the president of the U.S. Nelson Mandela followed Gandhi and won freedom for South Africa. All of them followed Gandhi's method of non-violence.

I had an opportunity to visit Robben Island near Cape Town. This is the island where Nelson Mandela was imprisoned by white people in South Africa for 18 out of 27 years of his jail term. Imagine the hatred that Mandela should have accumulated against white people. When I went to see the jail, my guide was a black man who had lived as a prison inmate with Mandela for eight years. Out of curiosity, I asked him what was special about Mandela's personality. He replied, "Nelson made a deep impact on me. He liberated me of my hatred for the white people!"

This is what non-violence did. In Richard Attenborough's film *Gandhi*, it is difficult to forget the scene of salt satyagraha in Dharasana. The British soldiers are beating the satyagrahi men and women with blunt instruments. Skulls are cracking. Blood is flowing. But the non-violent satyagrahis don't even raise their hand. They can, but they don't. And that generated a global effect. Jesus Christ said that if someone slaps you on one cheek, turn your other cheek to him. The question then arises – why is non-violence effective? It is not an imaginary thing. We know of several instances where non-violence was effective. Why?

As scientists, we need to understand this unexpected effect, to be able to explain it. There exists love and tenderness in everybody's heart. It's a universal law of nature. The famous hunter Jim Corbett describes one episode: Once, while he was walking through the jungle, he heard the sound of bleating of a lamb. That lamb was lost in the forest. He saw the lamb and also saw a tigress lurching to leap on the lamb – a small, delicate, helpless creature. Jim Corbett aimed his gun at the tigress and waited. The tigress was crouching, slowly moving towards the lamb. Corbett was ready to fire. Suddenly, the tigress stood up, steadily walked to the lamb and started licking

it. She played with the lamb for a while and then disappeared in the jungle without harming it. Many of you also might have seen a similar episode on the Discovery Channel – a lioness protecting and befriending a fawn. The cruellest animals also exhibit that tender feeling of love towards a lamb or a fawn. Non-violence generates that deep natural tender feeling, love. It banks on this.

What happens in violence, the opposite of non-violence? Somebody hits you. The hit elicits anger and you hit back. The hit elicits a reaction. That's why Gandhi said that the law of violence is, "an eye for an eye, and soon the whole world will be blind". Violence generates equal and opposite violence. In fact, violence follows Newton's third law of motion: "For every action, there is an equal and opposite reaction". This law of physics applies to human psychology – violence begets violence, anger begets anger, strong words beget strong words. Non-violence turns this Newton's law in the opposite direction. If violence generates violence, love should generate love. If my strong, aggressive violent act towards others generates an equal and opposite reaction, then if my action is gentle, the reaction to it will also be gentle.

Vinoba Bhave explained it beautifully, and I was fortunate to be present when he expounded this difficult-to-understand concept. In a violent war, he said, you have to use increasingly stronger and destructive weapons. In the non-violent struggle, it is the opposite. Your response should be gentle and gentler and the most gentle; the cycle of violence will be broken and you will get more results – gentle and gentler. (His Hindi words were *soumya*, *soumya-tar* and *soumya-tam*.) This is the science of non-violence. Because you become gentle and gentler, more and more non-violent, there is a low or no reaction from the opponent. Vinoba Bhave further said that in the true non-violent state, there is no opponent. Nobody is your enemy. If your heart is full of love and friendship towards others, there is no enemy. There can't be. If you really have that love for others, even for your so-called opponents or enemies, then it will generate love. It is as simple as that. There is no enemy in non-violence because the enemy was in you. "Nelson liberated me".

Truth and non-violence are extremely powerful, insurmountable forces. When you follow them, when you become a non-violent seeker of truth, you become a *satyagrahi*, one who insists on truth using non-violence. That's why Gandhi wanted his workers to become 'Satyagrahi Scientists'. A *satyagrahi* should become a scientist and a scientist should become a *satyagrahi*. *Satyagrahi* is one who insists on truth, one who is not *duragrahi* (who insists on untruth) or *ahankara-agrahi* (egoist). To seek truth, to be scientific, we have to be non-violent, open to others' views, accepting of truth, accepting of the refutation of our hypothesis. That is why non-violence is necessary to reach truth. In fact, non-violence is a science of mind, a science of reac-

tion of mind. That's why Gandhi said, "Truth and non-violence are as ancient as the hills". It is as if he was saying, "I have not invented them; they are based on nature's laws". Just like violence exists in nature, non-violence and love also exist in nature.

As I understand it, that is the science underlying non-violence, the science underlying Gandhi's methods.

GANDHI'S RELEVANCE TO THE 21ST CENTURY

Finally, we come to the last question: How is Gandhi relevant in the 21st century, relevant to us?

The 21st century faces three global challenges. The first is the curse of capitalism – infinite greed, and the humongous economic and political inequality. The second is the curse of consumerism – excessive consumption leading to climate change. And third is the curse of communalism – leading to racial and interfaith violence. These three are the most important global challenges before the humanity. So, what does Gandhi offer?

While these challenges are external and global, Gandhi's solutions to these are internal and personal. For a global problem, we usually seek global solutions. For the external problem, we seek external explanations and solutions. Gandhi was absurdly simple; but that's why he was different and unique. His solutions were internal and personal.

What is his solution for greed and accumulation? In today's for-profit, capitalist world, greed has become good. In the Hollywood movie *Wall Street*, the hero says, "greed is good". The more the greed, the more the accumulation, the more the profit. That invariably leads to economic inequality. According to Oxfam International's inequality report, 2% of the people own 98% of the world's property and wealth. Nine persons in India own wealth more than that of half the population of India – seventy crore people. Only nine persons! It's intolerable inequality. Such a society is often cruel, undemocratic and unstable. This is the inevitable curse of capitalism.

To this, Gandhi's solution is not killing the capitalists or those nine people. His solution is a personal attribute – *aparigraha*, which means non-accumulation, non-possessing or possessing as little as possible. This principle comes from Jainism, Buddhism and also the Patanjali yoga. *Aparigraha* is the anti-thesis of greed, the insatiable desire for more possession.

His other solution to the curse of capitalism was trusteeship. You may own a lot of capital, a lot of wealth, but you voluntarily become a true trustee of it and use it for the social good. Not surprisingly, during Gandhi's own time, the leftists laughed

at him. The capitalist is a man-eating tiger; he would never become a trustee. Gandhi is an idealist idiot, they said, or, even worse, he is cunningly providing a cover-up for the capitalists – Bajaj and Birla, his financial supporters. But now we see Bill and Melinda Gates, Warren Buffet, Azim Premji, the Tata and so many others giving away their wealth for social purposes. They seem to realise that, after a particular limit, what could they do with their wealth? It doesn't give any additional joy or pleasure; it's better to use it for the benefit of others. That seems to be more satisfying. They seem to be confirming that Gandhi was correct in his diagnosis of the human mind.

So, Gandhi's solutions to the ills of capitalism are *aparigraha* and *trusteeship*. They are based on deeper understanding of the human psychology. They are personal and internal. They are real.

The curse of consumerism leads to the excessive use of fossil fuel and global warming that will destroy life on Earth, including human beings. Gandhi's solution is again a simple change in the human behaviour – body labour, '*sharir-shrama*'. Nature has endowed human beings with a body that must be used by resorting to productive, useful physical labour. Gandhi even considers it sacred, an ethical and moral duty. You must do *sharir-shrama* every day. You must earn your bread through *sharir-shrama*; it's called the bread labour. He makes a *vrata*, a law of conduct of this. If you live by *sharir-shrama*, you will not be a parasite on others. You should consume only as much as you produced with your *sharir-shrama*. Then you will not consume nature's limited resources in an unlimited fashion.

Gandhi's solution has multiple potential effects. It offers a partial solution to obesity (physical capitalism), economic inequality, and even to the class and *varna* inequality. The *vrata* of *sharir-shram* brings everybody on the same plane. And, of course, reduces the excessive use of fossil fuel. For our infinite desire for pleasure, he recommends '*a-swad*', disinterest in the pleasure of taste as the antidote. These are all personal solutions that you and I can employ.

For the current global wave of communal hatred and the consequent violence – inter-faith violence, racial violence, terrorism, Taliban and the Bajrang Dal – the solution is not a bomb against the bomb or gun against the gun or the *murdabad* against *zindabad*. His solution is love and non-violence.

Today's acute problems are global and external, and Gandhi's solutions are internal and personal, and hence, they begin with yourself.

Some years ago, I had gone to an international conference in London. The conference was treated as important. We, the delegates, were taken first to the Queen's Palace and then to the Parliament, where we went to the House of Lords. There was a reception for us. I was uncomfortable. This is not my usual world. When we came

out of the parliament building, right in front of it, in the open space, I saw some people protesting. I felt an instinctive closeness to them. So, I broke off from the delegation and approached the protesting groups. There were three different groups. One was of the environmentalists – protesting against global warming and appealing to the British government to sign the Kyoto Protocol. The second one was a pacifist group – it was appealing to the government to bring back soldiers from Iraq. And the third one was asking for higher wages and better working conditions for the British labourers. Three different political groups were protesting in front of the British Parliament for different demands. Behind them was a huge common banner uniting them. It read, “Be the change yourself that you wish to see in the world”, a quote from Mahatma Gandhi.

I felt that even sixty years after his death (at that time), he was still protesting in front of the British Parliament and challenging global powers. He was appealing to us – to be the change that we wish to see in the world. You don’t have to run after the world to change it. You don’t have to go and fight the wars elsewhere. You don’t have to wait until the global policies, and the political and economic orders change. Change can begin with you, right here and now. Gandhi offers us an instant revolution!

That is why and how he continues to be very relevant today!

CONCLUSION

To summarise, the impression that Gandhi was anti-science is unfounded. This is my first finding. The second finding is that Gandhi was an ardent follower and keen user of scientific knowledge and methods, especially experimentation. Third, he added the test of morality to the methods of material sciences, be it the vivisection or methods of mass production or mass destruction. Everything was tested on the basis of morality and ethics. Gandhi’s unique strength, his greatness, was located not in using science; that is commonplace. His greatness was in his moral methods; that is what made Gandhi special. His two major moral principles were truth and non-violence. For him, truth was ultimate. This is the faith of a scientist. Gandhi used a very sensitive and refined, but subjective, method of the voice of conscience to connect with, to know, the moral truth. His non-violence appears to be consistent with Newton’s third law of motion applied to human psychology and behaviour. Gandhi offers internal, personal and moral solutions to the three urgent global challenges of the 21st century. This is what we find in the exploration on Gandhi and science, and of Gandhi’s relevance to the 21st century.

Let us return to the original dilemma of the editors of *TIME* magazine. The magazine selected Albert Einstein as the Person of the (20th) Century. But Einstein had already found a solution to the dilemma when, after Gandhi's death, he said, "Generations to come will scarce believe that such a one, in flesh and blood, ever walked on this earth". This is an ultimate tribute to Gandhi – the tallest scientist ever saluting the tallest man of his time.

TIME magazine was right. If Albert Einstein was the person of the 20th century, then I would venture to say, that Mahatma Gandhi will be the person of the 21st century.

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4

KNOWLEDGE SWARAJ, AN INDIAN MANIFESTO FOR S&T

IASc-DBT Gandhi Lecture: 27 March 2021

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In today's talk I hope to draw upon some of my earlier work on Gandhi's views on science, written 22 years ago (Prasad, 2001). The purpose of that article was to invite both Gandhians and scientists to look beyond the then-prevailing narrative which indicated that while Pandit Jawaharlal Nehru had a lot to say on science and was instrumental in building our scientific institutions Gandhi, revered as the Father of the Nation, had little connect with science or scientists. However, while looking at Gandhi's *Collected Works* for my research, I found that he repeatedly invoked science and engaged with scientists throughout his life. Gandhian scholars and science policymakers have often inferred his views on science based on *Hind Swaraj*. I found that there was so much more that he wrote and spoke about since 1909, especially in conversations with fellow workers, that it would be an injustice to 39 years of practice and engagement since. The article was in a sense the first attempt to collate and present these ideas for us to explore a "road not taken" in Indian science – an incipient vision of an inclusive and people-centric science policy that is prob-

YouTube lecture link: <https://www.youtube.com/watch?v=B4shjUF0F4E>

ably as relevant today, as we discuss the new Science, Technology, and Innovation Policy (2021).

It is in the conversations Gandhi had with scientists like J C Bose, P C Ray, Sam Higginbottom and many others that we see an alternate conception of institutions as well. In today's talk I hope to dwell on this continually evolving dialogue that Gandhi had with scientists and his engagement with fellow countrymen. The article then was to explore the missing Gandhi in science policy and the missing science in Gandhian studies. This, I believe, is a continuous exploration and would require us to go beyond the persona of Gandhi and possibly explore the method he experimented with—founded on the principles of truth and non-violence – and the design of alternate institutions such as the Satyagraha Ashram in 1915 (soon after his return from South Africa), the All India Spinners Association (AISA) in 1925 and the All Indian Village Industries Association (AIVIA) in 1934. This is apart from the lesser-known Gandhi Seva Sangh, originally set up with Jamnalal Bajaj in 1923, that he sought to convert into a post-graduate institute of research in 1943. In my work on “Science in the Khadi movement” (Prasad, 2002) I had tried showing that the idea of Gandhi's institutional framework for an alternate science policy did not necessarily die after his death and this notion of the experiment or the *Prayog* continued much after Gandhi's death as well through institutions like the Khadi Gramodyog Prayog Samiti. One could extend this in the 1970s with many scientists like C V Seshadri, Amulya Reddy and others being inspired by Gandhi even if they never met him (Seshadri and Visvanathan, 2002; Prasad, 2005; Reddy, 2004).

In my talk today I would like to look at Gandhi as an inspiration, and also try and have a conversation around, and go beyond, the historical Gandhi. I also hope to bring a more science technology and society studies (STS) perspective on understanding the relationship between science and society, an exploration of science in civil society (Prasad, 2005). Gandhi's major contribution, I think, is the possibility of reconfiguring this relationship of science and democracy, both during his times and something that we could explore in contemporary India and the world. This search or quest for a non-violent science has found several expressions by many. The most prominent that comes to mind is the work by J B S Haldane. In Haldane's later years in India he was trying to rework biological sciences drawing from local knowledge and sought to shape a new modern biology better suited to Indian needs. Haldane believed, and trained his students, in observational skills that often did not require expensive equipment (Dronamraju, 1987). Haldane did not believe in the centre-periphery model of science. He believed and demonstrated that good science could emerge from Bhubaneswar as much as from Bangalore or Bombay, the then epicen-

tres of scientific knowledge. I suppose one day a historian of science might want to explore these ideas from Gandhi to Haldane to C V Seshadri and others more systematically. The latter's work with the Department of Biotechnology had a different flavour to research and people's engagement than much of the transgenic research that is popular today.

I would thus argue that you can continue to work along what one might call a broader agenda of Gandhian Knowledge Swaraj without necessarily having met Gandhi or even being a Gandhian wearing Khadi clothes. Haldane never met Gandhi but was in a sense experimenting with Knowledge Swaraj. In my talk I draw upon this recent understanding of Science, Technology and Society studies (STS) where science, technology and more recently innovation have now been extended into the understanding of knowledge. So when I speak on knowledge, I use the term a bit more broadly than just referring to science, technology and innovation as a linear pipeline of how things evolve. STS encourages us to look at a more distributed and polycentric relationship between not just modern science and technology, but also its relation with other knowledge forms, especially when we discuss these ideas of a knowledge society.

In today's talk I would like to begin with an autobiographical account of how I ended up getting involved in understanding Gandhi's views on science. I then explore Gandhian science beyond the historical Gandhi and its extension briefly in the Khadi movement, and finally I extend this to try and recreate a citizen's manifesto on science and technology – a manifesto that was inspired by Gandhi's *Hind Swaraj* but does not quote it anywhere in the document. It is a contemporary document and an attempt to try and see whether citizens can play a more active role in shaping science policy in India. And I'd like to share a few thoughts on the Science, Technology, and Innovation Policy draft that has just come out, and I would say that we do need to take within this context the Indian knowledge society much more seriously.

EXPLORING GANDHIAN SCIENCE: A FAILED EXPERIMENT

I would like to narrate a failed experiment in the field: After my Master's, I spent about four years working with craftspeople. During our work in Adilabad district, a lot of the cotton grown would go a long distance to Mumbai to get spun in the spinning mills, some of it returning as yarn for the handloom weavers. In not too distant memory, a few houses in remote villages had handmade gins and the idea was to try and see – in collaboration with the local department – whether it was possible to revive hand-spinning and hand-weaving. And the organization I was working

with, Dastkar Andhra, had expertise in natural dyes, which they trained the weavers in. There was a large amount of cotton procured and the ginning had started but unfortunately the seeds were getting crushed. And as a young engineer, I felt that the fault perhaps lay with the fact that the technology had advanced a lot and these gins had not kept up pace.

A colleague Uzamma instead said, “What if the issue was not with the gin but with the cotton variety?” While the hand-gins had not changed much, the cotton varieties had – from the indigenous “desi” with hard seeds to the American hybrids whose seeds were softer and would get crushed. She had rich insights on cotton and this intuitive leap, focusing on the link between indigenous cotton processing and growing, was based on her understanding of hand-spinning with traditional varieties of cotton in Ponduru in the Srikakulam district of north coastal Andhra Pradesh. We then embarked on understanding cotton varieties. The famed Dacca muslin we realised were from short staple cotton that, like the Ponduru cotton, would be categorised as unspinnable in modern textile parameters best suited for making gunny bags. The same variety though could be made into fine fabric by the indigenous processing techniques. If you went deeper and looked at the history of Indian cotton, you would realize that the process of introducing American cotton, which started about a hundred years ago or so, expanded significantly post Partition. This failed experiment actually led into a longer search from the archives, which led to a study exploring the history of technology and the Khadi movement that questioned notions like “how did staple length become a determinant of what is considered good quality cotton?” (Prasad, 1999). The cotton story highlights some of the discussions on the supposed universality of science and technology, and even the parameters of quality and standards. Rather than a natural progress of science, choices of technologies are often determined by historical and socio-cultural processes. We often favour some pathways and ignore others, and when we face a crisis, we might have to revisit our assumptions.

A parallel in agriculture is the loss of indigenous varieties of rice to dwarf varieties during the Green Revolution. Indigenous varieties lost out in many parts of India when they were not sufficiently responsive to fertilizers during the Green Revolution. A renewed interest in nutrition, aroma and biodiversity might today encourage us to look at a different agronomy founded on the principles of agro-ecology to explore indigenous knowledge very differently today. In the case of cotton, archival records were indicating to us that if only the speed of the machines were slower (those used in Britain were built for American cotton varieties), the damage to Indian cotton would have been less and thus one could look at an Indian industrial revolution differently.

While we arrived at this through archival records and other experiences, I realised that the Khadi movement had already been in the know of it. These insights were put together and shared at the Traditional Sciences and Technologies of India Conference in 1993 at IIT Bombay and later in 1995 at Anna University. The idea was to have a knowledge dialogue where spinners from Srikakulam could converse with the cotton technologists in CIRCOT (Central Institute for Research on Cotton Technology) from Nagpur and Bombay. In the process of writing the article (Prasad, 1999), I found that many of these insights actually featured in a special section called the “Khadi notes” in an otherwise extremely political journal, *Young India*, that Gandhi started in 1919. I also discovered the significant contribution of Maganlal Gandhi to the whole spinning movement. Maganlal was Gandhi’s right hand man, the scientist who would meticulously follow up Gandhi’s insights and translate them into practice at the Sabarmati Ashram. Maganlal died early in 1928 and Gandhi in a rare tribute, “My Best Comrade Gone”, reflects on his contribution to the Khadi movement. It was because of Maganlal Gandhi’s efforts that Khadi was revived. Though Gandhi had a vision for India’s freedom movement through Hind Swaraj or self-rule through the revival of hand tools, he was initially confused between a spinning wheel and a handloom. But it is actually people like Maganlal Gandhi who worked on the technology, taking ideas from the Madras presidency and rooting it at the Ashram. Maganlal wrote the “Charkha Shastra” in 1923. To my surprise I found that Gandhi used science and technology articulated very differently in the articles in *Young India*, using phrases like “khadi science” and “science for sacrifice” that were very different from his denouncement of machines in *Hind Swaraj*.

The more I began looking at the archives on Khadi, the more I found Gandhi speaking on science. The article (Prasad, 2002) situates Gandhi’s writing within discussions on science policy that often ignores Gandhi. And if I might say so, Gandhi is almost like a subaltern as far as science studies are concerned. So, there is a missing mention of Gandhi in science studies, as much as there’s a missing science dimension in Gandhian studies. In Gandhian studies there is a lot of discussion on his political philosophy, a little bit on his constructive work, but very little on his vision for science. Gandhi’s *Collected Works* indicate that from 1909 to 1938 he had enormous correspondence with his coworkers and many others too on science.

Gandhi’s early critique of modern Western science emerges with the connection he makes between science and colonialism. If science is strongly linked to the colonial project of the Empire, it would be morally bankrupt. He, however, makes a subtle distinction in his articles in *Indian Opinion*, in which he expresses his awe of the courageous and the experimental spirit of scientists. In the construction of his

ideas, he suggests that India does not need to be industrialised in the ‘modern sense of the term’, suggesting that India could have an alternate path of industrialisation and progress.

In his own definition of his self, he says, “I am not a Saint, I am a humble searcher after truth. I am one who knows his limitations and makes mistakes. And like a scientist is making experiments about the eternal verities of life”. So, in a sense, *Hind Swaraj* was an argument essentially with the intellectual classes of both India and abroad. In contrast, we have a different register in which Gandhi is speaking to his coworkers. So the first point in Gandhi’s understanding of science is that it is not a pushback, as Aldous Huxley seems to indicate, into an imagined past where everything was glorious. In fact Gandhi, as Bhikhu Parekh would suggest, was a “critical traditionalist” (1989). So, he valued the knowledge system of Ayurveda but is opposed to vivisection because it ignores the claims of the subhuman. Vivisection looks at “man as a tyrant” instead of “the protector of subhuman or lower creatures”. He opposed vivisection and valued the fundamentals of Ayurveda as a knowledge system. Yet, he was very critical about the Ayurvedic practitioners because they don’t seem to embody the spirit of experimentation that is perhaps prevalent in the research of modern scientists.

Gandhi was in a sense not as much anti-science as deeply dissatisfied with the direction that modern science is taking. He would have liked to imbue Indians with the spirit of science. In a conversation with an Ayurvedic practitioner he said, “I do like everything that’s ancient and noble, but I utterly dislike a parody of it”. In this subtle difference is a search for what he called a “Satyagrahi scientist” – scientists who should be willing to give their knowledge and effort to the larger cause of society than individual or private profit.

In one of the popular photographs of Swaraj and India’s independence is his visit to the Indian Institute of Science (IISc) in 1928. In one such photograph, one notices C.V. Raman in the background. Gandhi kept this dialogue with scientists in the 1920s even as he was interested in establishing an alternative scientific practice. There is this quote where he uses the word science broadly, “the science of Khadi requires technical and mechanical skills of a high order and as much concentration as is given by Sir. Jagdish Chandra Bose to the tiny leaves of plants in his laboratory, before he wrests from them, the secrets of nature held by his fellow-creatures for us”. At IISc, in his address to students, he suggests that “all the discoveries that you make have the welfare of the poor as the end in view. All your workshops will be really no matter than Satan’s workshops”. There is this constant dialogue where he suggests that while he may not be a scientist with a degree, but as a citizen, he had a reason

to try and have a dialogue with the scientists and imbue them with questions which society seems to be asking us. Gandhi presents the example of Vinobha Bhave as an example of a devoted worker who brought about improvements in spinning and presents the concept of “spinning for sacrifice” a concept that he chose to extend to scientists too.

The announcement of a Rs. 1 lakh prize for an improved charkha is well known. What is interesting here is the role of society in setting the axioms for research that a technical expert could do. Gandhi outlined the six broad criteria on which the prize would be judged. While there was no eventual winner, a closer look at this correspondence reveals the constant dialogue that he had with people, including the Kirloskar brothers. In these experiments is a fascinating story of how, through these processes, society is “speaking back to science”, to use Gibbon’s phrase. We thus see a different conception of science society regulations, and very specifically, and I think this is an important contribution of Gandhi – to articulate a science in civil society. This is seen as an autonomous space that is different from science of the nation state or science wedded to the concept of the market. It is here that these notions of alternate institutions also emerge.

There is this beautiful quotation of Gandhi where he says that the “ashram to him is a scientific and prayerful experiment”. The Ashram was not a religious conception of the way we look at our ashrams historically, but a place where people like Vinoba Bhave and Maganlal Gandhi, and many others, would come and carry out experiments, spin and grow cotton, and so on. So while traditionally more women were doing the spinning activity, at the Ashram more men than women spun. For Gandhi, India’s scientific institutions were to be seen as a continuity and a revival of an Indian arts and crafts movement.

He says, “we do not have the Samuel Crompton and James Hargreaves because of the vicious Indian system of considering the crafts as something inferior and diverse from the skill”. Much of this articulation comes after his Harijan Tour of 1933-34 where he realizes, also possibly because of his dialogue with Ambedkar, that Indian society has separated the head and the hand, and the artisans do not seem to have the same kind of dignity that possibly the artisans of the Western part of the world seem to have. At the inauguration of the All India Village Industries Association in 1934, he talks to scientists and says, “The field (of village industries) is so vast that it will tax all our business talent, expert knowledge and scientific training. ... We shall need a number of scientists and chemists prepared to lay not only their expert knowledge at our disposal, but to sit down in our laboratories and to devote hours of time, free of charge, to experiments in the direction I have indicated.” He narrates

how he sent a letter to most of the scientists across the country to ask them about the chemical properties of jaggery or gur and laments, “is it not a tragedy that no scientists should be able to give me the chemical analysis of such a simple article?” The point essentially is that the direction of mainstream science has probably ignored the requirements of village industries.

A lesser-known aspect of Gandhi’s own work is this institution called the Gandhi Seva Sangh, which was set up in 1923 and was meant for the constructive workers. Gandhi’s desire to disband the Congress in 1946-47 is often quoted though incompletely. This disbanding was to be followed up with the reconstitution of the Gandhi Seva Sangh that he conceptualised as an institution for the future and as a “Postgraduate Institute of research”. However, it is interesting to note that if we follow the method of Gandhian science, this notion of Prayog and the notion of science and civil society was practiced for at least 20 years, which I’ve seen in the case of the Khadi movement, much beyond Gandhi’s death.

And just to give a few instances, they were these Prayog Charcha Sabhas, where people would get together and discuss how to improve the charkha. They had these Saranjam Sammelans or instrumentation conferences where an idea would be put forward and people invited to share their way of solving this problem. Much of this was published in this unique journal in Hindi called *Ambar* between 1958 and 1972. It arguably is one of the earliest technical journals in Hindi and had about 800-odd subscribers across India. The driving motto seems to be the need for civil society to engage with science. No politics was discussed and the journal had sections like “From the Experimenters”, “Field Experiences from the Khadi Centers”, “What is Agricultural Science” and so on.

SCIENCE IN CIVIL SOCIETY

This idea of science in civil society was very much a part of Gandhian imagination of science and did not die soon after his death, either. This idea of “science in civil society” needs exploration and STS as a discipline helps us look at an alternate science-and-society relation. The Chicago exhibition (1933) has a particular view of science and society: “science finds, industry applies, man conforms”. Society is at the end of this linear model of innovation, which has been questioned significantly ever since, most famously by Michael Gibbons, who talked about a new social contract of science in 1999, a “context-sensitive science” and this idea of society “speaking back to science”. Sheila Jasanoff (2003) refers to this notion of “technologies of humility”. Can we work in that direction? The scientific enterprise seems to have gone astray at

some levels, and she suggests that we need to look at the ideas of framing and keep asking what the purpose of science is, looking at issues of vulnerability, i.e. “who will be hurt by certain kinds of projects”, the issue of distribution, i.e. “who benefits”, and finally about “how do we know” about these complex problems.

The physicist John Ziman, in possibly his last book (2016), talked about science and civil society where he makes this claim that today knowledge production is concentrated in far fewer hands. And he says, “there are times when laypersons, technically unqualified individuals, ought to be given an active, responsible part in the production of scientific knowledge. It is the context that speaks through them. They need to be included, not just in popularizing science, along with the scientific experts in the groups that draft and review research programs and project proposals”. This is an ambitious ask, but it’s a direction that I think many of our science policy frameworks need to get into.

And this is something coincidentally that happened globally around 2008-10 or so with the Manifesto movement where there was a rethinking of science globally. “A New Manifesto” by the Science Policy Research Unit and IDS at Sussex talked about the three Ds, or the directionality of science, its distributional aspects and the need to look at diversity. It was around the same time that we had autonomously or independently worked on the Knowledge Swaraj manifesto. In 2007, STS scholars also talked about the need to take the European knowledge society seriously. They encourage us to look beyond science, technology and innovation and frame the discussions around “knowledge society”.

The European Union has a green paper on research and innovation that suggests that “The research, business, government and civil society communities and citizens are called upon to engage in this important debate”. A mention of civil society was made in the National Innovation Council (NIC) when India launched its decade of innovation, where there was a specific mention that there should be “a space for discourse” and even an explicit articulation of the need for subversive discourses and irreverent discourses, that’s articulated in 2013. I think the NIC doesn’t exist in its form anymore.

TOWARDS KNOWLEDGE SWARAJ

It is in this context, I would like to articulate this idea of Knowledge Swaraj, which suggests in some sense that along with “self-reliance” or “atmanirbharata” of an S&T policy of India, it is equally important to look at S&T as “self-rule” by Indian people of their own S&T, including its institutions (KICS, 2011). Can we start thinking

from the perspectives of the people of India when drafting the policy document? This might require us to reinvent Indian democracy and its social institution. The manifesto reinstalls the citizen as an expert, not as a ‘layperson’ but one with a different kind of expertise. There is a detailed discussion on the citizen as an inventor: the manifesto recognizes the richness of the parallel knowledge systems, and also celebrates the morality of the weak and the marginalised. It encourages us to take our knowledge society seriously and resonates with Wynne *et al.* (2007) in the primacy of providing collective learning a central place in a knowledge-centred society.

STS scholars in Europe refer to the unease with science and how to improve democratic governance. There is a reference to two innovation regimes. One, a regime that is akin to providing techno-scientific promises: “We will give you this particular kind of gizmo that is going to solve things”, and so on, as opposed to a different kind of regime of innovation that is focused on collective experimentation. And I think in our science policy documents historically, and even now, the latter part has not been expressed sufficiently. The recommendations of the European knowledge society talk about the need to shift to plural conditional, not a single prescriptive advice; value the social distribution of knowledge; and even create a community research council. Why can’t our science policies explore these ideas in practice? This idea of supporting autonomous collective experimentation is an idea whose time has come. The Knowledge Swaraj manifesto articulates these concerns in the Indian context, albeit completely independently.

The manifesto has five chapters: The first chapter talks about the need to interrogate expertise and not to look at this duality between an expert and the layperson but to try and look at the knowledge of the public in a different manner and the kind of expertise that will allow for engagement with modern science and technology as well. The second chapter explores this idea of social contract of science and relates it to Gandhi’s phrase of trusteeship. Can we look at a new role of science and what might be the social institutions of science in India? The third chapter presents the framework of the triad of “sustainability, plurality and justice” as key concepts to think ahead: the recognition of the plurality of Indian knowledge systems in which modern science is an important part but not the only one, and the need for justice of the marginalised and weak, not only in terms of access and issues but also in terms of the knowledge getting respected and the idea of “cognitive justice” (Visvanathan, 2009).

The fourth chapter briefly raises the issue of techno-science and ethics, asking how we reconstruct sustainability, and provides an example of how such a Swaraj might be in the energy sector. The final chapter “Towards Knowledge Swaraj” pro-

vides some directions to carry out this new knowledge and why Swaraj needs several democratic experiments. The manifesto mentions a few which include learning from some experiments about like the Dutch societal dialogues on nanotechnology that looked at science governance very differently from risk governance. So, broadly, as I mentioned earlier, all of this is moving towards an articulation on the role of civil society in science Swaraj.

After the draft of the document was done, the idea was to try and take out a few pilots led by civil society organisations other than academia. The five pilots were in diverse areas like sustainability and plurality in the built environment, experiments in democratizing the water sector, and on climate justice and agriculture (whose knowledge counts?). An interesting case of medical hysterectomy highlighted the issue of technological responsibility or its absence. Hysterectomy, which should not have been an option for tribal women in Telangana, 20 kms away from the medical capital of Hyderabad, was prescribed and practiced through an insurance scheme for the poor, Aarogyasri, in a macabre play of science, state and market going astray.

The key to the pilots was to have an engagement with scientists on societal issues and concerns. Thus, the climate justice case was on how do we take the science of climate to the communities and how can the community's concerns be addressed by the discussions on climate science? Through these dialogues, scientific institutions such as the National Institute of Nutrition and a civil society organisation (CSO), the Centre for World Solidarity, both probably just about a kilometre apart from each other, got together. Similarly, scientists from the National Institute of Plant Health Management got to listen to and engage with the alternate conceptions of knowledge - Non Pesticidal Management (NPM), that the Centre for Sustainable Agriculture, a CSO, has been working on.

Facilitating this dialogue can create capacity for a newer kind of science. And this science is not a turn back to what was in the past, but a creation of new knowledge through collective experimentation. This needs many engaged experts, and civil society has an important role to play in this process of creating new knowledge. Knowledge Swaraj needs socialisation of science and newer institutions in capacities. Academia has a newer role in facilitating these knowledge dialogues by bringing different knowledges together. This idea of inclusive innovation, articulated in India's recent science policy, cannot happen without the processes and institutional innovations that make it possible. Can we look at science policy as articulating Swaraj and can we evolve indicators beyond the metrics of access and spending on R&D, finally giving it the importance of technological responsibility? If you create a system, in this case medical hysterectomy, can scientists or medical professionals be divorced

from its consequences? Does technological responsibility end with just the creation of science and blame the misused on the (lack) of extension systems?

So finally, just a few words on the Science, Technology, and Innovation Policy, that's come out very recently. The draft has gone out for circulation. What is interesting and commendable about this process is that unlike, let's say, the farm bills, there has been a significant consultation where, despite the pandemic, it was possible for the Department of Science and Technology to hold these dialogues across sectors and 300 people were consulted. There is a separate chapter on equity and inclusion, which probably was not there before. There is also a mention of citizen science and public engagement. But one would say that the conception of civil society is still seen only as outreach, that they come at the last part of what one would consider as a linear model of innovation and not in the possibility of setting goals and directions of how science should be in India. And I think that is something which is not going to happen in six months or a year, but this is where I think Gandhi's *Hind Swaraj* comes in handy. As mentioned earlier, this is not possible without new institutional platforms and processes for collective experimentations and knowledge dialogues.

So I end with the suggestion that we need to move from "Atmanirbhar" to Knowledge Swaraj, especially in trying to rethink all the relations between science and society post the pandemic. The emerging statistics is anything but comfortable. The Pew Research Center suggests that a significant number of Indians are slipping into poverty post pandemic. There is a need to revisit Gandhi's talisman that will remind us of the myriad challenges that we face today and encourage us not to be complacent about our achievements on becoming the centre of vaccine diplomacy. Within India, we have extremely growing inequality post-pandemic.

Finally, there is also this newer challenge on how we perceive and understand truth, a central concern of Gandhi. This was brought out quite well by the film *The Social Dilemma*, in which scientists and engineers talk about "creating a system that biases towards false information, not because we want to", as some of the technologists in Google and other kinds of places speak off in the film, "but because false information makes the companies more money than the truth".

What is the countervailing power that can try and rein this almost autonomous and independent direction of technology? Here is where we need to get these ideas of Gandhi back in a sense, asking this question on whether Gandhi's talisman can help us address some of these challenges of growing inequality and whether it can help us rethink the science–society relations by reemphasising truth and non-violence in our future S&T policies.

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5

FACING THE ATOM BOMB: GANDHI, OPPENHEIMER AND THE QUEST FOR NONVIOLENCE

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The title of my article may seem to be a provocative teaser. However, Mohandas Karamchand Gandhi and J. Robert Oppenheimer did indeed 'face' the atom bomb.

How did the 'apostle of nonviolence' and the 'father of the atomic bomb' grapple with that cataclysmic invention? The contrast between the two men is obvious. It is the seemingly fragile common ground between Gandhi and Oppenheimer's struggles that interests me.

Gandhi's whole life was dedicated to experimenting with nonviolence in the spirit of a scientist. Oppenheimer's life was dedicated to theoretical physics but collided with painful questions about ethics and the future of human civilisation.

In this context, there are some questions that have been commonly debated for decades. Should scientists have split the atom at all? Was it ethical for science to be deployed for mass destruction?

YouTube lecture link: <https://www.youtube.com/watch?v=-iTnknFMC1U>

I am deliberately not going to engage with these questions today. Instead, my purpose is to focus on a still more fundamental concern, that is, to ask if humanity has any future at all if our default response is to overcome violence with greater violence. This question applies as much at the level of an individual as a group or country.

Does the dawn of the atomic age make non-violence inevitable or incongruent? Gandhi's answer to this question is well-known. Oppenheimer, of course, did not directly engage with this question at all. Nevertheless, his conflicted and complicated life helps us to explore the ground on which this question has arisen.

This narrative has broadly three parts: First, I will briefly observe how Oppenheimer and Gandhi 'faced' the atom bomb. Second, I will explore what drove them – Oppenheimer, a pacifist, to build a weapon of mass destruction; and Gandhi, a deeply religious man, to approach nonviolence in the spirit of scientific experimentation. And third, I will examine what clues their struggles offer us on the possibility of nonviolence and the future of humanity.

I

Ironically, both Oppenheimer and Gandhi faced the atom bomb in ways that surprised and even dismayed their peers.

Oppenheimer's response is perhaps better known but still bears repetition here. On 16 July 1945, Oppenheimer, the scientific head of the Manhattan Project, presided over the world's first atomic explosion at a test site in the desert of New Mexico. In the tense days leading up to the test, Oppenheimer's sole concern had been whether the device they were testing would actually work. So, watching the first mushroom cloud rise high into the sky and feeling the heat of the explosion 20 miles away should have been a moment of triumph [1].

Oppenheimer did indeed feel relieved that they had not produced a 'dud'. But what he is remembered for is this, which he put on record some years later:

"We knew the world would not be the same. A few people laughed, a few people cried. Most people were silent. I remembered the line from the Hindu scripture, the Bhagavad-Gita; Vishnu is trying to persuade the prince that he should do his duty, and to impress him, takes on his multi-armed form and says, 'Now I am become death, the destroyer of worlds.' I suppose we all thought that, one way or another." [2]

We will later see why this dimension of Oppenheimer disturbed the American political establishment.

Gandhi's first reaction to the news about the deployment of an atom bomb was a stunned stillness. "I did not move a muscle when I first heard that the atom bomb

had wiped out Hiroshima”, Gandhi wrote. And as you would expect, he also said that “I regard the employment of the atom bomb for the wholesale destruction of men, women and children as the most diabolical use of science” [3].

From August 1945 to the day he was killed in January 1948, Gandhi repeatedly expressed his conviction that the atom bomb has not antiquated nonviolence. “On the contrary, non-violence is the only thing that is now left in the field. It is the only thing that the atom bomb cannot destroy. . . . Unless now the world adopts non-violence, it will spell certain suicide for mankind” [4].

The invention of atomic weapons did launch the age of MAD, or Mutually Assured Destruction, a term quite coolly deployed by military and strategic experts.

And yet Gandhi’s way of ‘facing’ the atom bomb is yet another, quite challenging, story. On 30 January 1948, just hours before he was killed, Mahatma Gandhi was interviewed by the American photographer and *LIFE* Magazine correspondent Margaret Bourke-White.

“How would you meet the atom bomb with nonviolence?”, the journalist asked Gandhi.

Gandhi replied, “I will not go underground, I will not go into shelter. I will come out in the open and let the pilot see I have not a trace of ill will against him. The pilot will not see our faces from his great height, I know. But the longing in our hearts – that he will not come to harm – would reach up to him and his eyes would be opened” [5].

These words of Gandhi disturb many who admire him and seek inspiration from him in striving for nonviolence. This passage even angers some of my friends because it is seen as making nonviolence either absurd and/or inaccessible to ordinary people.

Before looking more closely at this angst and whether these words of Gandhi make the quest for nonviolence more difficult, let us shift gears and spend some time on the two very different worlds of Oppenheimer and Gandhi, and how, oddly enough, they had something profoundly in common – the Bhagavad Gita.

Gandhi and Oppenheimer, two vastly different men, both leaned heavily on the Bhagavad Gita and it was not the only thing they had in common. Both men were born into privilege. Both had difficult youths and suffered from diffidence before developing strong self-confidence.

Both men also shared a deep curiosity about the nature of reality. If Oppenheimer was driven to unravel the secrets of physics, Gandhi was driven by the need to unravel and redefine politics. Both shared a longing for universal well-being based on justice and dignity for all.

There were, of course, crucial differences.

Gandhi was deeply engaged in seeking divinity. Oppenheimer, though drawn to the lyrical beauty and wisdom of the Gita, was a firm atheist. Gandhi never wavered from the conviction that violence could not be overcome with more violence. Oppenheimer felt obliged to work on the atom bomb because he saw this as a way to stop the violence of fascism. Gandhi's life has become a beacon that will light the way for generations to come. Oppenheimer's life and legacy haunt us.

II

Oppenheimer's childhood was shaped by his parents' engagement with the Ethical Culture Society, a group that celebrated rationalism and secular humanism. The authors of *American Prometheus*, which has been acclaimed as the definitive biography of Oppenheimer, describe Ethical Culture as a way of life that promoted social justice over self-aggrandisement. As his biographers Bird and Sherwin wrote, "It was the irony of Robert Oppenheimer's odyssey that a life devoted to social justice, rationality and science would become a metaphor for mass death beneath a mushroom cloud" [6].

Like much of his generation in the West, Oppenheimer's adult life was shaken by the rise of Nazis in Germany. In the mid-1930s, he was contributing three percent of his annual salary to a fund that enabled Jewish scientists to leave Germany in order to escape persecution. By the early 1940s, like many of his peers, Oppenheimer was convinced that the Nazis must be defeated at all costs.

During the gruelling two years when Oppenheimer was leading the effort to make the atom bomb at Los Alamos in New Mexico, he was driven both by the fear of Nazis beating them in this race and his own personal ambition. The historian James A. Hijiya writes:

"Looking beyond the impending destruction of enemy cities in the current war, he was dispirited by the prospect of continued development of nuclear weapons after the war. In this time of uncertainty Oppenheimer revisited one of his favorite books, the Bhagavad-Gita, and from it drew encouragement that steadied him in his work." [7]

Oppenheimer's story is fascinating at two levels.

One is the personal dimension of how his sense of duty, to do his best as a scientist for the war effort, was in conflict with the ethical dilemma of inventing the means of mass destruction on an unprecedented scale. Oppenheimer was clear that the atom bomb is "a weapon for aggressors, and the elements of surprise and terror are as intrinsic to it as are the fissionable nuclei" [8]. Like many scientists at Los Alamos, Oppenheimer genuinely believed that because the bomb was so terrible it would not be used again after being dropped on Hiroshima. The American decision to drop a

second bomb on Nagasaki shook him. On 9 August, the day the bomb was dropped on Nagasaki, a Federal Bureau of Investigation informant reported that Oppenheimer was a nervous wreck [9].

My enquiry today is more concerned with the second dimension of Oppenheimer's story – his crystal-clear articulation of why, in military terms, the atom bomb was an exercise in futility. For, there could be no adequate or effective military countermeasures to nuclear weapons. Within days of the Nagasaki bombing, as the head of a scientific panel, he wrote to the Secretary of War, Henry Stimson:

“We are not only unable to outline a program that would assure to this nation for the next decades hegemony in the field of atomic weapons; we are equally unable to insure that such hegemony, if achieved, could protect us from the most terrible destruction. . . . We believe that the safety of this nation – as opposed to its ability to inflict damage on an enemy power – cannot lie wholly or even primarily in its scientific or technical prowess. It can be based only on making future wars impossible.” [10]

Later, in the 1950s, opposing nuclear weapons made Oppenheimer a target of Senator Joseph McCarthy's witch hunt to catch suspected communists. Oppenheimer was put through a gruelling interrogation and then stripped of his security clearance.

To the best of my knowledge, there is no record of Oppenheimer being interested in the workings of ‘nonviolence’ as such. Yet the anxieties, guilt and dilemmas he struggled with are the raw materials of the impulse that underlies the quest for nonviolence.

Oppenheimer starkly acknowledged the absurdity to which nuclear weapons have reduced humans:

“What are we to make of a civilization which has always regarded ethics as an essential part of human life [but] which has not been able to talk about the prospect of killing almost everybody except in prudential and game-theoretical terms?” [11]

This illustrates why Gandhi insisted that the modern era was not a civilisation at all. But that was because, for Gandhi, civilisation was not equated with sophistication of technology or economic organisation but with that which shows us the path of duty. In the early 1930s, when a British reporter asked Gandhi what he thought of the modern civilisation, Gandhi replied, “it would be a good idea ”.

It is from this vantage point that I now explore Gandhi's way of facing the atom bomb and his claims that nonviolence is the only option left if humankind hopes to have a future.

Both the First and the Second World Wars were touted as the ‘war to end all wars’. Gandhi, like many others, knew this claim to be invalid. History is full of wars that were claimed to be the only way to bring peace. He saw the atom bomb as the inevitable and ultimate outcome of this false claim:

“Peace through superior violence inevitably leads to the atom bomb and all that it stands for. It is the completest negation of non-violence and of democracy which is not possible without the former.” [12]

Gandhi was equally unimpressed by claims that the horror of the atom bomb would lead to ahimsa. This would be a temporary state, Gandhi argued, driven by disgust over the bomb’s destructive power; the world was very likely to return to violence with renewed zeal after the effect of disgust is worn out.

Gandhi wrote this in *Harijan* in July 1946:

“So far as I can see, the atomic bomb has deadened the finest feeling that has sustained mankind for ages. There used to be the so-called laws of war which made it tolerable. Now we know the naked truth. War knows no law except that of might.” [13]

It is in this context that Gandhi insisted that nonviolence is the only thing left which the atom bomb cannot destroy. But what, for Gandhi, was ‘true nonviolence’?

First and foremost, Gandhi was clear that nonviolence is not merely absence of physical assault.

“Nonviolence in the sense of mere non-killing does not appear to me, therefore, to be any improvement on the technique of violence. It means slow torture and when slowness becomes ineffective we shall immediately revert to killing and to the atom bomb, which is the last word in violence today.” [14]

In the 21st century, the World Health Organization (WHO) definition of violence reflects this understanding. Violence, as per the WHO website, is “the intentional use of physical force or power, threatened or actual, against oneself, or against a group or community that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation”.

For Gandhi, ahimsa is the positive energy that is released when we overcome the desire to harm someone. It is the process of working to overcome destructive emotions such as fear, anger and hatred within oneself. At its highest level, ahimsa is the presence of love-in-action. For Gandhi, ahimsa was anchored in what he called ‘soul force’.

At the same time Gandhi insisted that ahimsa is a science because it lends itself to experimentation. And ‘failure’, Gandhi pointed out, has no place in the vocabulary of science. For “failure to obtain the expected result is often the precursor to further discoveries” [15].

Gandhi even titled his autobiography ‘*My Experiments with Truth*’, in which he gave a detailed account of his experiments with many dimensions, including nonviolence, and the discoveries they led to. These discoveries were as much outward as inward. The inner life, of the mind and consciousness, and its outer manifestations were seamlessly one.

In both domains he applied himself with ruthless rigour. For instance, Gandhi insisted that ahimsa can only truly be tested in an atmosphere of violence.

If the function of violence is in the largely material realm and its intention is to devour all it comes across, “the function of ahimsa is to rush into the mouth of *himsa* (violence)” [16].

This, for many people, is the problem – and makes Gandhi almost inaccessible and/or difficult to follow.

How can the power of physical force be compared with the power of minds and bodies determined to resist but not through physical force or retaliation?

We may admire Gandhi when he says, “I make bold to say that in this age of Atom Bomb unadulterated non-violence is the only force that can confound all the tricks put together of violence” [17].

But what does it mean both in theory and in practice?

III

There is no single, definitive answer to this question.

In the recent Ahimsa Conversation, the scholar and former bureaucrat Gopal Gandhi pointed out that it is the strength of nonviolence that there is no one ‘manual’ for it, that each one of us is empowered to explore it in our own way [18].

There is, of course, a large volume of empirical evidence which enables us to test the hypothesis whether nonviolence can serve as an antidote to physical violence.

The experimentation in which Gandhi placed his faith has not only continued, it has intensified, gathered momentum and been extensively documented by the social sciences as well as by activists themselves.

Quite apart from this, both the natural and social sciences have garnered evidence to overturn earlier claims that violence is more ‘natural’ to human beings. Some of the key findings of this research are as follows:

- The impulse to fight back with physical force was indeed an important element of the evolutionary process, but this does not mean we are necessarily descendants of the ‘killer ape’, a primate species that had greater capacity for interpersonal aggression.
- Primatologists have been able to show that our ancestors’ capacity to cultivate cooperation, mutuality and even compassion played a crucial role in both the rise of *Homo sapiens* and the emergence of human societies.

- This is further borne out by research which shows that in order to train soldiers to kill, armies have to actively break down an innate resistance to killing. Despite that, many people sent into combat tend to suffer from perpetration-induced traumatic stress (PITS).
- In the early 1980s, UNESCO assembled a council of natural and social scientists to reflect on whether war is innate to our species. The Seville Statement on War, which emerged from this process, declares that neither war nor other violent behaviour is genetically programmed into human nature: “Just as ‘wars begin in the minds of men’, peace also begins in our minds. The same species who invented war is capable of inventing peace. The responsibility lies with each of us” [19].
- Contemporary practitioners of nonviolence have reported their own experiences, along with other evidence, to show how this works. American academic and nonviolence activist Michael Nagler writes: “A nonviolence response originates in the struggle to master emotional forces inside ourselves; and my guess is that this very struggle is what feels so meaningful and makes the nonviolent peak experience ‘addictive’. Conflict is an opportunity for conversion” [20]. Nonviolence as a tool of political action has been established well beyond India. The documentary film ‘A Force More Powerful’ has assembled actual footage to document both the theory and practice of six historic nonviolent struggles – each of which demonstrates that nonviolence as a value and a method is learnable, replicable and verifiable [21].
- Like many phenomena in the natural world that are not visible to the human eye, such as radio waves, nonviolence can exist without being obviously visible. A somewhat quixotic example of this is the Danish story of surrendering to the Nazis without a fight and then maintaining a steady campaign of resistance that undermined the Nazis. The high point of this story is how the Danish people mounted a massive secret operation and successfully rescued their entire Jewish population just before the Gestapo could imprison the Jews and send them to concentration camps [21].

It is vital to note that when Gandhi says that the atom bomb makes nonviolence an imperative, he is not referring to the possibility of an all-out nuclear war that could potentially kill the majority of humans and make the planet uninhabitable for the few who live through the holocaust. Revulsion in the face of this scenario is not nonviolence. It is a response arising from our most raw and basic instinct – to survive.

Gandhi's stand against the atom bomb is actually quite similar to Oppenheimer's. It is a moral stand anchored in concern for our species' highest potential, not merely its survival.

Of course, this approach flies in the face of the dominant and common understanding of how human conflict works. That is why President Truman was reportedly appalled when Oppenheimer spoke of having "blood on my hands" and appealed for the ban of nuclear weapons.

This is why Indian activists who oppose India's becoming of a nuclear-weapon state are attacked and accused of advocating 'weakness' or being 'anti-national'. For a view from the ground, please see Ahimsa Conversation #48 in which social activist Sandeep Pandey describes both the opposition and welcome encountered during the anti-nuke peace marches which Pandey has led [22]. The UN treaty banning nuclear weapons came into effect on 22 January, 2021, but this is largely symbolic. There are no visible signs of the nuclear stockpiles being dismantled anytime soon.

It is in this context that I will now attempt to address the discomfort some of you may have felt about that quotation of Gandhi saying that if an atom bomb were actually falling he would look up into the sky and pray for the pilot.

I imagine that this discomfort could be of two opposite kinds. One is to think that Gandhi had a Jesus-like divinity and could therefore pray for those annihilating him. This would put nonviolence out of reach for ordinary mortals – then it could only be worshipped from a distance.

The other kind of discomfort may arise if you see Gandhi's stand as an act of absurdity and futility.

It might help to examine Gandhi's position logically* [23]:

*The full quotation in which this reasoning is spelt out:

"There have been cataclysmic changes in the world. Do I still adhere to my faith in truth and non-violence? Has not the atom bomb exploded that faith? Not only has it not done so, but it has clearly demonstrated to me that the twins constitute the mightiest force in the world. Before it the atom bomb is of no effect. The two opposing forces are wholly different in kind, the one moral and spiritual, the other physical and material. The one is infinitely superior to the other which by its very nature has an end. The force of the spirit is ever progressive and endless. Its full expression makes it unconquerable in the world. In saying this I know that I have said nothing new. I merely bear witness to the fact. What is more, the force resides in everybody, man, woman and child, irrespective of the colour of the skin. Only, in many it lies dormant. But it is capable of being awakened by judicious training. It is further to be observed that, without the recognition of this truth and due effort to realize it, there is no escape from self-destruction. The remedy lies in every individual training himself for self-expression in every walk of life, irrespective of response by the neighbours". Harijan, 10.2.1946.

Has not the atom bomb proved the futility of all violence? Harijan 10.3.1946. *Mind of Mahatma Gandhi*, 447.

- Gandhi's axiom is that truth and nonviolence are inextricable, and together form the mightiest force in the world.
- The atom bomb is an opposite force.
- The two opposing forces are wholly different in kind – one, moral and spiritual; the other, physical and material.
- Nonviolence is infinitely superior because it is ever progressive and endless.
- The atom bomb, by its very nature, has an end.
- The potential for nonviolence resides in everybody – man, woman and child – irrespective of the colour of the skin. Though it lies dormant in many, this capability can be awakened by judicious training.
- It is further to be observed that, without the recognition of this truth and due effort to realise it, there is no escape from self-destruction in the atomic age.
- The remedy lies in every individual training herself for self-expression in every walk of life, irrespective of what others do.

But what if Gandhi's praying for the pilot were seen as an impetus for not placing him on a pedestal but were seen as Gandhi pointing to a capacity latent in all of us.

One of my mentors – the engineer, social activist and spiritual seeker T. S. Ananthu – has suggested that this is precisely what Gandhi is here inviting us to do, namely, to acknowledge the existence of the entire universe within our own mind and consciousness. "So, when Gandhi said he would make eye contact with the pilot of the bomber", Ananthu said in a recent email, "he was referring to the 'seat of consciousness' of the pilot, which he could access within himself. This is a different way of looking at reality but one that science is inching towards. Once that is done, it will become evident that his 'looking the pilot in the eye' was neither absurd nor futile, but a very practical way of dealing with a difficult situation".

Interestingly, it was one of Oppenheimer's students, David Bohm, who made seminal contributions in this direction of looking differently at reality. Bohm wrote about a deeper, hidden 'implicate order' that underlies physical appearances, or the 'explicate order'. Bohm's conversations on these issues with J. Krishnamurti are an important resource for all those who wish to delve deeper into this.

CONCLUSION

By now, you probably know that I am convinced that in the atomic age the future of humanity depends on nonviolence.

My purpose has been not so much to convince you, or even urge you, to share my conviction. My attempt has been only to open up spaces for an ongoing reflection.

In this context, as scientists you are bound to face harsher dilemmas than any that I face in the realm of social and political action. As this narrative has shown, what science is in itself is one thing; what can be wrought through science in the command of state power and corporate power is yet another story for another time.

So in closing, let us return to Gandhi, Oppenheimer and the Bhagavad Gita.

Oppenheimer took from the Gita the message of duty as the primary morality. This led him to see the atom bomb as inevitable, his own role in its creation being instrumental. “If you are a scientist you cannot stop such a thing”, he argued [24].

Gandhi defined duty as fundamentally an inner quest to overcome fear, anger, lust and other afflictive emotions – in order to enable ‘soul force’ to grow within. His outward efforts for nonviolence as a way of life and of political action were an extension of this inner quest.

Whichever of these two approaches appeals to you as a scientist, as a citizen and as a sentient being, either way there is no escape from grappling with the reality of violence in many forms.

I hope it helps to know that each of our individual struggles is being played out in a time of great opportunity. Whatever else may now happen, the striving for non-violence can never be put back in the spiritual cloister, from whence Gandhi pulled it out and placed it firmly at the centre-stage of politics, society and all future attempts to be civilised.

I had vital help from several friends in placing these thoughts before you– so I would like to thank Ananthu T.S., Anjum Rajabali, John Dsouza, Nihar Nilekani, Rohini Nilekani, Sachin Rao, Sudhir Chandra and Walter Mendoza.

I will close on with these lines from the Bhagavad Gita, which Oppenheimer recited to a colleague on the eve of testing the atom bomb:

“In battle, in forest, at the precipice in the mountains
On the dark great sea, in the midst of javelins and arrows,
In sleep, in confusion, in the depths of shame,
The good deeds a man has done before defend him.” [25]

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- [6] As a young man Oppenheimer proved to be brilliant at both physics and languages – and nurtured a life-long passion for literature. In the early 1930s he learnt Sanskrit, while at Berkeley and soon discovered the Bhagavad-Gita. So fascinated was Oppenheimer with the world of Sanskrit that in 1933, when his father gifted him a car, he named it 'Garuda' – the mythical bird who carries Vishnu across the sky. Source: *American Prometheus*, p. 10.
- [7] "The Gita of J. Robert Oppenheimer" by James A. Hijiya *Proceedings of the American Philosophical Society*, 144 (Jun., 2000). 123-167.
https://www.jstor.org/stable/1515629?read-now=1&seq=3#page_scan_tab_contents Accessed on 18.3.21.
Once the bomb was tested, Oppenheimer believed that decision making shifted to the military experts. Earlier, a group of scientists involved in the Manhattan project, had petitioned the President of the USA, urging him not to use the bomb and instead invite the Japanese to observe the denotation at 'Trinity', Oppenheimer's name for the site of that first explosion. Source: *American Prometheus*.
- [8] *American Prometheus*, 324.
- [9] *American Prometheus*, 317.

- [10] *American Prometheus*, 318. As a footnote, since we are gathered at the Academy of Sciences, it is important to add that, at this point, Oppenheimer was also depressed as a physicist. In late 1945 he told a Senate committee that the whole wartime spirit was “one of frantic and rather ruthless exploitation of the known.” He lamented that during the war “we perhaps witnessed a . . . total cessation of true professional activity in the field of physics, even in its training.” Source: *American Prometheus*, 322.
- [11] *American Prometheus*, xi.
- [12] Harijan 30.3.1947. *Mind of Mahatma Gandhi*, 147.
- [13] Harijan 7.7.1946. *Mind of Mahatma Gandhi*, 448–449.
- [14] Harijan 24.2.1946. Source: *My Non-Violence* by M. K. Gandhi. Compiled and edited by Sailesh Kumar Bandopadhyay, Navajivan Publishing House, Ahmedabad, 1960, 226.
- [15] Harijan 6.5.1939. *Mind of Mahatma Gandhi*, 123.
- [16] Harijan 13.5.1939. *Mind of Mahatma Gandhi*, 123.
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[24] Speech to Association of Los Alamos Scientists, 2 November 1945. Source: Hijiya, 143

[25] *American Prometheus*, 305.

6

KEY TO HEALTH: BUILDING SOLIDARITY THROUGH WOMEN'S COLLECTIVES

IASc-DBT Gandhi Lecture: 21 May 2021

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I would like to begin by paying homage to the fellow citizens we have lost to the pandemic and offering my sincere condolences to the families who have faced these unbearable losses. Like all of you, I pray that our collective suffering ends as soon as possible.

At such times, I turn to Gandhiji for solace and guidance on the way forward. I found Gandhiji's message through my work at the Self-Employed Women's Association (SEWA). It was only then that I understood how relevant his message, values and ideas are for life and living, and especially for the poorest and most vulnerable in our country – women workers of the informal economy – who have shared their struggles and hopes with me for several years now. Thanks to this lecture, I read some material on Gandhiji's views on science and health that I had not seen before. His views on

YouTube lecture link: <https://www.youtube.com/watch?v=ZTVIXwcCPT4>

technology and doctors were articulated clearly to all of us in *Hind Swaraj*, written more than a hundred years ago. Many of you would also know that ‘science without humanity’ was one of the Seven Sins that he wrote about. But until recently I had not come across *Key to Health*, a book* he wrote in 1906 in South Africa, then entitled *Guide to Health* and re-printed in 1942 with a new title, while he was confined at the Aga Khan Palace in Pune [1]. Gandhiji said that this was most popular of all his writings. He advised that “Anyone who observes the rules for health mentioned in this book will find that he has got in it a real key to unlock the gates leading him to health. He will not need to knock at the doors of doctors and vaidyas from day to day” [2]. As usual, he was prophetic and ahead of his times. We need to revisit these ideas for preventive action on health, especially as we grapple with the current COVID-19 pandemic that is unfolding with tragic consequences in our country and elsewhere, even as we speak.

Without even knowing about this book, at SEWA we have been working on many of the ideas Gandhiji wrote about over a hundred years ago, and hence, I thought it was fitting to borrow his title for this lecture.

Another reason for starting with Gandhiji’s ideas is that they have inspired not only our health work and our attempts to take science to informal women workers, but also because his values inspire all that we have been doing for almost fifty years now at SEWA. Satya (truth), ahimsa (nonviolence), sarvadharmā (equal respect for all faiths) and swadeshi (focusing on local production and consumption), among other values, have been our guiding principles for all action. When in doubt, we remind ourselves of Gandhiji’s vision for Swaraj – not only obtaining our political freedom, but also eliminating poverty, exploitation and injustice, and putting ourselves – especially the poorest – firmly on the path to self-reliance.

SEWA was established in 1972 by Ela Bhatt, a labour organiser and lawyer. Born into a family of freedom-fighters, Elaben (as she was called) was deeply influenced by Gandhiji’s call to serve the poorest of Indians in rural areas. Later, she joined the Textile Labour Association or Majoor Mahajan Sangh, a mill workers’ union founded by Gandhiji and Anasuyaben Sarabhai in 1918 in Ahmedabad. It was there that she was first exposed to the world of work of the majority of the Indian workforce, especially women. Supabai, a head-loader from the main wholesale cloth market, approached Elaben in the late 1960s for support in the struggle for minimum wages with the wholesale cloth merchants for whom they worked. Moved by the plight

*My sincere thanks to Kinnari Bhatt at the Sabarmati Ashram, Ahmedabad, for pointing me to this book and other articles and publications which enriched my knowledge of Gandhiji’s views on science, health and women.

of Supabai and the other women who carried loads on their heads for barely a few rupees per day, Elaben began to organise them.

Organising is the process of uniting workers and building their solidarity for collective action, and through their own collectives like unions, cooperatives and other self-help groups (SHGs). Supabai, with Elaben's support, led other women head-loaders in negotiations with the cloth merchants. This first effort at organising informal women workers led to wage increases for the women, and also led to the creation of a tripartite board, with representatives of the workers, the cloth merchants and the labour department. This board continues till today and provides welfare benefits to head-loaders, in addition to fixing wage rates.

At SEWA, informal women workers are organised on the basis of work and livelihood, and include women from all castes, creeds and communities. SEWA was registered as a union and is now a national union with 18 lakh members in 18 states – the first of its kind in India. We soon realised that we needed different strategies when organising informal women workers, most of whom were self-employed, for their rightful place in our economy and society. When women said they needed financial services to free them from the clutches of money-lenders, and when the nationalised banks would not open accounts for them, 4000 women contributed Rs 10 each as share capital and formed their own cooperative bank in 1974. They were among the pioneers of the microfinance movement. At present, SEWA Bank has over 5 lakh depositors and working capital of Rs 500 crores – all from small savers, our members. Over its almost 50 years of existence, SEWA Bank has helped lakhs of women to save, obtain loans for their businesses, and get access to other financial services like pension and insurance.

Following this first effort at creating solidarity through a cooperative, we realised that this is a powerful strategy to organise women. As we organised women in the 1970s, we found that it was very hard for them to strike and, in any case, most of them were self-employed. To whom were they to present their needs and demands? There was no employer. Therefore, to increase their bargaining power in the labour market, we began to form collectives – mainly cooperatives because in Gujarat we have a strong cooperative movement. But as we organised women in other states, we experimented with other forms of organisations – farmer producer organisations, not-for-profit and for-profit companies, and more. In all of these collectives, women are the users, managers and owners. Now, there are 150 formally registered collectives within the SEWA movement and thousands of informal, community-based self-help groups (SHGs) across India.

As SEWA grew, women said that they needed basic healthcare. They told us:

“Our bodies are our only assets. As long as we are healthy and can earn, we can feed our families and hope for a better future for our children”. The need for this, and the gap in even basic health services for women, emerged starkly when SEWA Bank conducted a study in 1977 of women who were not repaying their loans regularly. The findings shocked us into taking action for health. Of the 500 women surveyed, 20 had died – 15 of them from causes related to childbirth. And among the rest of the women, sickness was the number one cause of indebtedness. We began a maternity benefits initiative – members contributed towards extra nutrition by providing ghee for pregnant women (also our members) and linked them with health services for safe childbirth. Later, the Gujarat government took this up as a scheme for landless agricultural labourers and implemented it for some years.

I joined SEWA in 1984 to develop a community-based, women-led primary health-care programme for SEWA members and to address the huge gap in healthcare that emerged from the SEWA Bank study. I studied history and science at university and planned to be a marine biologist and later, a physician. Writing my thesis in college on healthcare in India, I realised that it was not so much a paucity of doctors, but more that they were just not where they were most needed – in our villages and in low-income urban neighbourhoods. In addition, we needed to address the causes of sickness most urgently through public health action. Hence, I trained in public health and joined the SEWA team to work among informal women workers.

The first thing that struck me was the lack of scientific information among poor women about the human body, its illnesses and how to stay healthy, which are especially required given their meagre resources and limited access to healthcare. I spent the first six months observing and learning in a sprawling neighbourhood, Shankarbhuva, on the banks of the Sabarmati River. Women in Shankarbhuva were all informal workers: street vendors, scrap metal collectors, domestic workers and some cleaned used tins for a living. They had been organised into our union and many had accounts in SEWA Bank. Some had taken loans and developed their fruit, vegetable and scrap-metal businesses.

I also learned that in urban Ahmedabad at that time, people had more faith in their local healer or ‘bhuva’. I witnessed some of the bhuva’s practices at Shankarbhuva – some quite scientific, like the use of turmeric and herbs, and others that were downright harmful. When a young woman was abandoned by her husband and her baby girl was taken from her, leading to depression, the bhuva made a fire with red chillies and made her inhale it to remove the spirit that had ‘possessed’ her. Another young woman suffering from mental illness was locked up in a room and fed scraps that were thrown at her till we convinced her family that all she needed was love and

care. Tuberculosis (TB) was widely prevalent, but people were afraid to get check-ups and were not aware that free treatment was available. Despite our efforts, several women did not survive. When we linked up with the municipal authorities for free TB medicines, the women said they did not have the time to queue up for these at the hospital. Who would bring in the income to feed their children? And anyway, they could not afford proper food when taking the antibiotics.

I had been taught about the social, economic and political factors influencing people's health in public health school, but here I saw it playing out in real life. The women told me: "We would like to be clean but our turn to bathe comes once in three days – water is a problem here. And our toilet is the river bank. We get up at dawn before our men-folk". The social determinants of health – or lack of these like water and sanitation – could not have been more evident.

Primary healthcare with a preventive focus was the immediate need then – as it continues to be now as well. The current pandemic has yet again brought this home to us: the high cost in lives and livelihoods prevent investing in primary healthcare and there is no secondary and tertiary care to back this up. Primary healthcare includes action on the social determinants of health like clean water, toilets, nutrition, early childhood education and more. Our members told us to start by educating them on health and setting up a crèche for their young children, so that their children were cared for while they were at work. We did both. Later, the crèche we set up was taken over by the government's Integrated Child Development Scheme (ICDS) and continues to this day. Some of the women stepped forward to take health literacy classes. Of the first ten health workers, only half knew how to read and write. It was challenging to develop ways to support their learning – through practical demonstrations, repeated training sessions to ensure that women got the information they needed and refresher sessions. It was a slow but exciting process of discovery and mutual learning. When we had a session on anatomy, we were surprised how much women knew. They said it was because they reared goats and ate them too! And yet, they had little scientific knowledge of reproductive physiology and the aetiology of common diseases like TB and malaria. Diarrhoea and respiratory infections were an everyday occurrence among children, but there was little knowledge about early action to prevent dehydration or respiratory distress.

I remember Sumanben, a datan or toothbrush vendor, explaining how she felt after one of our training sessions: "I have had six children but had no idea about my body and all that happens during pregnancy. How could I if no one ever shared this knowledge with me?" She also told me: "Women like me have to have 4 to 6 children so that 2 or 3 survive". She was both student and teacher, and soon began

sharing her new knowledge with thousands of others like herself. Shardaben, the young woman who had been locked up in a room, became one of our most active health workers. She said she found the will to live once she began helping others with her new knowledge and skills as a health worker. Women learned first aid and how to take care of the everyday illnesses they saw, and when to refer and accompany their community members to a doctor for more care.

Along the way, we learned how to present scientific information on the human body and on diseases in a simple manner, demystifying medicine for local people, especially women. These health workers began a programme of health literacy in Shankarbhuvan, and soon similar health education and awareness was initiated in other parts of Ahmedabad, and then rural areas as well, by a growing team of enthusiastic health workers – Ayesha, Laxmi, Yasmin and Leela, all SEWA members. Interestingly, we found that our health work encouraged more informal women workers to join SEWA, as they found this service useful, low cost and appropriate. Thus, health action was an important part of organising workers and building their solidarity for collective action – on health and other workers' issues.

When we had a core team of 50 community health workers, we decided to form a health workers' cooperative. By 1990, SEWA had formed several cooperatives – of artisans, farmers, cleaners and more. There was considerable goodwill on the part of the state cooperative department with regard to registering SEWA-promoted cooperatives. But the department had never had a request such as ours. How will you ever be financially viable? What will you sell? How will you raise revenues? We were faced with these questions from the authorities but managed to convince them, after two years of discussion, to register us as Lok Swasthya SEWA health cooperative. This too, like the parent organisation SEWA, was the first of its kind in the country – a cooperative of, for and by women frontline health workers.

Soon after, a revenue-generating opportunity presented itself to Lok Swasthya SEWA. In our discussions with women, we realised that the high cost of medicines was significantly increasing their out-of-pocket costs and using up their hard-earned resources. Instead of utilising their monies for better food, housing and other basic amenities that promote health, they were spending it on drugs about which they knew little or nothing, and because of the costs involved, they did not take the full course of medicines prescribed. They urged us to provide low-cost medicines. With Rs 70,000 working capital, we began to provide low-cost, quality-controlled and generic drugs to our members. We bought the medicines from the wholesale medicine market and with a modest mark up to cover our costs, we began a small medicine counter at SEWA. We also provided information on rational, scientific drug therapy – simple

do's and don'ts – to the women. Within a year, the counter not only paid for itself but began making a small profit. Thus, we found a revenue model for our health cooperative just by following women's needs and health expenditure priorities.

Soon the municipal authorities asked us to replicate this model in their hospitals and provided some seed capital. Our small experiment with low-cost medicines has now grown into a chain of three low-cost pharmacies-cum-rational drug therapy education centres. Two of them are located just outside large public hospitals. Our prices are competitive and we are open around the clock – and all are staffed by women, our members' educated daughters. These pharmacies led to Lok Swasthya SEWA health cooperative becoming financially viable for the last thirty years. The profits now finance some of our primary healthcare and health literacy programmes. They also helped to finance an Ayurvedic medicine production unit, as we found that these were even cheaper, locally acceptable and with fewer side effects. Each batch of our formulations is quality-tested and certified by the Drug Commissioner in Gujarat. We also have a Good Manufacturing Practices (GMP) certificate which has increased our orders from both government and others.

One of the challenges we faced in taking science and basic healthcare to informal women workers was their belief systems, both health and socio-cultural. When we went into villages thirty-plus years ago, women would take their babies and disappear into the fields nearby when we spoke of immunisation. They had no faith in vaccination – not unlike some of the barriers we face today with vaccination against the coronavirus. But today in these same villages, almost all the children under five are immunised. This is no doubt due to the enhanced public health efforts of our government, considerably strengthened from the time when we began our primary healthcare work forty years ago. But I think it will be fair to say that the tireless and ongoing efforts of our village health workers contributed to this as well.

On another occasion, a young mother administered a little too much opium to her baby to keep her quiet while she harvested her wheat crop. The child could barely breathe. We had to act fast. Her family said it was a waste of money to save the life of a baby girl. We had been active in that village for some time and had several members there. They convinced the family and the little one was saved as we rushed her to the hospital in time. After that we never had to convince anyone in that village about timely health action and equal care for girls and boys.

Bringing healthcare to local people by women, and in a manner that is appropriate both from people's point of view and that of science, is not always easy. TB has always been a top priority of our members. Fortunately, a doctor from WHO, Geneva, sought us out, and together we identified bottlenecks in the control of this 'raj rog' or

‘king of diseases’, as our members called it. One of these was the opportunity cost of going to a facility to be tested and to obtain a regular supply of drugs, even though these are free of cost. Hence, our health cooperative developed the idea of running a diagnostic laboratory close to where TB was rampant. WHO was ready to fund this pilot laboratory in a low-income neighbourhood and it would be staffed by local women, who would be trained by WHO and the Ahmedabad Municipal Corporation. The latter were ready to try a new approach to a vexing problem and perhaps had some faith in SEWA. But the ‘higher authorities’ in New Delhi were not convinced. It took us two years of negotiation to actually implement our programme. Finally, a laboratory was set up, young women were trained to look for bacilli through a microscope, and stocks of the TB drugs were kept, which were dispensed to people by a doctor. Local women SEWA leaders called ‘aagewans’ were trained to be DOTS workers, in the government’s then-new Directly Observed Therapy Short-course (DOTS) programme to fight TB.

The DOTS workers ensured that every TB patient took their daily medicines, encouraged them to stay the course, and helped them get access to special cash support. DOTS workers often went to the homes of patients at the crack of dawn, before they left for work, tracked them down when they went to their villages and monitored them carefully until they were cured. In time, the results of their painstaking and tireless efforts began to show.

It was a proud moment for us when the municipal corporation felicitated our team for having the highest case detection, case-holding and cure rate. We exceeded the standard cure rate of WHO and our defaulter rate was very low. Later, when more resistant strains of TB developed, the DOTS workers doubled their efforts. It showed what can be achieved if only we have faith in local people, especially women, and their ability to learn, and act collectively to deliver health outcomes.

A similar struggle ensued when we started a school for training traditional midwives. Although the training course was to be supervised and managed by an experienced gynaecologist, we faced stiff opposition from the local gynaecologists who even threatened us with legal action. Most of the midwives or dais were not literate and had no numeracy skills. But they had years of experience in delivering babies in their villages and were enthusiastic to learn scientific methods and to obtain new knowledge. We had the same gynaecologists who opposed us take the examinations of the dais at the end of the course. The dais silenced the critics by their performance in the exams – all had passed! Along the way, they learned to read and write as they needed these skills to measure blood pressure, weight of pregnant women and their abdominal circumference, and to note these down in their registers.

Another area of health action was our work on occupational health. As we interacted with women as workers, and not just as mothers, we noticed the toll taken on their bodies by back-breaking work, and often with hazardous substances or processes. Back pain and eye strain were commonplace but not considered worth investigating by the local authorities, who told us these were not emergencies. Tobacco and bidi workers, almost always women, complained of breathlessness, loss of appetite and eye-strain. Women farmers said the tools they used caused body ache; waste recyclers cut their hands and were exposed to toxic substances, apart from carrying huge loads on their heads; construction workers suffered injuries and fractures regularly, and death by falling from heights was not uncommon among them.

Yet, scientists had hardly investigated these occupational health issues of informal women workers – leave alone recommend ways to address these. Fortunately, the National Institute of Occupational Health (NIOH) is located in Ahmedabad, where SEWA is headquartered, and a fruitful collaboration began. Each of us brought our strengths to this partnership between scientists and grassroots-level women. Other partners, also fortuitously located nearby, are the National Institute of Design (NID) and the Indian Institute of Public Health in Gandhinagar (IIPH-G). Scientists from NIOH and IIPH-G investigated the occupational health issues women faced with their active support. The NID designers helped to develop equipment to address some of the issues women were facing. These ranged from gum boots and sunglasses for salt workers who toiled in the hot sun, and a sickle to cut sugarcane which suited women's anthropometry and reduced body strain. It also included handcarts for head-loaders and waste recyclers. Posters in simple, local language were developed with scientists to prevent poisoning and deaths from pesticides on farms, and toxic solvents used in the rolling of agarbatti or incense sticks.

None of these were high-cost activities and yet provided some support and useful information to women. One of the ongoing challenges is how to help women get access to the equipment developed which would both enhance their productivity and reduce the stress and strain on the body. The new sickles only cost Rs 100, which women cane cutters could afford. However, the carts for head-loaders and waste recyclers were priced at Rs 4,000 per piece. We tried, as yet with no success, to provide these through the state's unorganised sector welfare boards who have still not recognised the importance of occupational health. In the meantime, we have managed to include occupational health and injuries in the insurance cover we offer to our members through the SEWA insurance cooperative, VimoSEWA.

Finally, in the past year, we have been further convinced about the power of taking science in a simple and understandable manner to local people, and the ability of

local frontline women workers to do this. When the coronavirus first spread a year ago, the need of the hour was for proper information to reach as many people as possible, and for early detection and referral. Again, women did not shy away from the task at hand. With technical assistance from WHO, we trained 800 grassroots women leaders from eleven states to reach out to people in their areas. Putting others' well-being before their own, these women went door-to-door, educating, encouraging and convincing their neighbours and others, dispelling their fears and supporting them for referral care by linking with public health services. Because we had been working closely with the local health authorities – both public and private – for many years, we were able to quickly partner to fight the virus wherever we could. Our health workers provided scientific information on coronavirus (simple do's and don'ts), reproductive and sexual health, where to go for further care and more. They reached 3,00,000 households in a month – all during the first lockdown – at a time when they themselves had little income and food. Because solidarity and sisterhood had been built over the years, women were able to help and support each other in this time of crisis. They identified the poorest and weakest in their communities – widows, single mothers, elderly and the sick – for priority action and not only provided them food and medicine but also ensured that they were not left out of government relief measures.

Further, SEWA Shakti Kendras – hubs for health and nutrition literacy, and forging linkages with government public health programmes – became relief and rehabilitation hubs for local people and the government. These centres were already in existence for some years and had developed rapport with local government authorities. When the pandemic struck, the SEWA Shakti Kendras became focal points for action to fight the pandemic. Local authorities used them as a centre for giving out cash benefits to women. They also became centres for disseminating scientific information on the virus and distribution centres for masks and sanitizers.

During this second wave of the pandemic, our aagewans have once again swung into action and are providing emergency health services – kits with paracetamol, thermometers and oximeters – and information on home isolation and care; they are reassuring sick persons and their families, and consoling those who have faced the loss of a loved one. They have taken some basic training in mental health and counselling, and are assisting in early detection and referral of people whose condition deteriorates. They are working hard to save lives.

All of these experiences have led to some significant learnings about taking information to people at the grassroots, and undertaking local action – the key to health for all Indians.

The first learning is that it is critical to invest our time and resources in taking scientific knowledge about health and well-being to the people. The current pandemic has driven it home to us like never before. In his book *Key to Health*, Gandhiji suggested that “we must in the first place know enough about the human body” [3]. I especially like his view: “The human body is the universe in miniature” [4].

His book is replete with suggestions on what to eat and how, the importance of air and water, and self-restraint in our food intake and all other aspects of life. There are practical suggestions for well-being, and a common vein running through the text is for us to take charge of our own health – self-care and care of others, and just as often self-help at the village level are emphasised. At this time of health emergency, when our citizens have been left to fend for themselves, how valuable his insights are for all of us.

As I mentioned earlier, not knowing of this book, but following his other ideas of going to the people, especially the poorest, we began our health literacy initiatives. It continues to be the most important aspect of our primary healthcare work. It is painstaking and often seems repetitive, but it is slow and steady work that few are doing – certainly not our public health system. What we learned from this health education work is that putting science in people’s hands is empowering. Equipped with new information and knowledge, there is a spring in the step of our health workers-cum-educators. They are respected in their communities for all that they know and also for their services in saving lives. Several of our health workers have been asked to stand for election in the panchayat or nagar palikas.

One such SEWA sister is Chanchiben, who is a poor, disabled Dalit. When SEWA members chose her to be the health worker of her village, men were outraged, especially the upper-caste ones. Chanchiben had hardly been to school but she worked hard and developed into a competent health worker. Soon, those who had opposed her as a health worker sought her out for help with medicines and also linkages with local health authorities. She was elected to the board of Lok Swasthya SEWA health cooperative. Her village leaders asked her to stand for election as sarpanch of the village. She was the keynote speaker at a forum of corporate leaders in Mumbai. When I accompanied her, she told me that no one in her community had ever been to Mumbai on a plane. And she was surprised when she got a standing ovation from the corporate leaders as she described her journey to empowerment.

The second lesson is that health and wellbeing can be achieved, at least in part, through solidarity created through women’s collectives. Chanchiben and thousands of others in the SEWA movement only obtained voice, visibility and validity through their own collective. Often our SEWA sisters say: “Who would know about us and

our struggles? It is only through organising, uniting and building up our own organisations”. And it is not only for visibility. It is also a practical way to reach services and entitlements to the poor. It is much easier for government officers to ensure outreach, and in a transparent manner, if they are interfacing with a collective, rather than individuals. This is even more so in times of crisis, like the one we are facing now.

Furthermore, through collectives, women and other vulnerable sections of our society obtain strength, the encouragement they need to learn and to break barriers, as Chanchiben did, and even alter power relations in their family and community. Collectives, and the opportunity they provide for women to come together and learn on health, for example, begin to alter gender relations as well. This new, scientific knowledge is brought into the home by women, and shared with their children and other family members. Everyone benefits from their newfound confidence and ability to challenge some of the patriarchal views on women and their health. Of course, women are quite practical and do retain traditions and beliefs that are useful, or at least not harmful.

Third, we have learned that when we place faith in local people, especially women, and their ability to learn and serve their communities, we are rarely disappointed. Not only are they ready to serve, but they also do so in an appropriate, timely and low-cost manner. They are quick to adapt to digital technology if internet and devices are made available to them. I have been amazed by how much they enjoy Zoom! I have already mentioned how women quickly took health information to local people during the pandemic and continue to do so in this latest surge of cases. These frontline workers are also learning about mental health and how to identify people needing support – critical at this time. Soon, they will be able to dispel unscientific ways of dealing with mental health, including locking up those suffering from depression.

Fourth, the collective helps women address the social determinants of health, only one of which is the health system. Others like livelihood, early childhood care, nutrition, water and sanitation, and more can only be addressed, in my experience, by collectives or solidarity organisations of local people, and in our case, informal women workers. This is because it is very hard for an individual woman to advocate for better water supply or toilets in her area, or full-day child care that will enable her to work and earn. But if she is part of a group, she finds the strength and bargaining power she needs to address these difficult issues. In Shankarbhuvan, my earliest experience with organising for health and with collectives, we went as a group to the Ahmedabad Municipal Corporation and to the elected ward councillor. The women were heard for the first time in their lives. The councillor used some of the funds allocated to him to build toilets. Later, we developed a programme of slum upgradation called

Parivartan with the municipal corporation. In Parivartan, women and their families got seven basic services, including a tap and toilet in every home, street-paving and garbage removal. Each household contributed Rs 2,000 and the corporation invested the rest – a total of Rs 22,000 per home for people's wellbeing. At long last, women had their own toilets and could bathe every day.

As most of the women in the area were street vendors, we took up the issue of their harassment by the police and municipal authorities, who regularly evicted them from the marketplace and confiscated their goods. They had to pay regular bribes to ply their trade. We obtained a favourable Supreme Court order to prevent eviction, and after a forty-year campaign, the Indian Parliament passed a law to protect street vendors' livelihoods. At long last, the harassment and unnecessary pay-outs stopped almost entirely. The money saved could now be used for better food, education and health. We now see that our vendor-members' sons and daughters are better educated and in better health, and have smaller families too.

For all these reasons then, I suggest that solidarity through women's collectives is the key to health. Solidarity through collectives also results in inclusion, deepening of democratic functioning, and decision-making and participation, especially of those who are usually forgotten or excluded, like informal women workers. When they feel they have both agency and knowledge, they feel empowered to act on all aspects of their lives, not least on their very health and wellbeing. Of course, there are various factors and aspects to be considered but ultimately, equipped with scientific information and with the strength of the collective, women and local people can take control over their bodies and lives. As we face the consequences of the COVID-19 pandemic – the tragic loss of lives and livelihoods – we would do well to remember the messages Gandhiji gave us long ago in his book. They are ones that continue to be relevant, and a reminder of how each of us can act, for ourselves, our families and for the common good of all in these challenging times.

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7

GANDHIAN SCIENCE IN THE INDIAN COTTON TEXTILE INDUSTRY

IASc-DBT Gandhi Lecture: 28 May 2021

UZRAMMA

Handloom Futures Trust, Andhra Pradesh

In this lecture I would like to consider why Gandhi chose spinning of cotton yarn as the vehicle of Swaraj.

Could anyone who met Gandhi in, say, 1893 in South Africa – when, dressed in Western clothes, the London-trained barrister was representing a prosperous merchant in a civil court case – have thought that Gandhi would one day not only change his attire to become what the Prime Minister of Britain Winston Churchill sarcastically called a ‘half-naked fakir’ but also put his finger on the crucial issue of village India’s poverty? How did this middle-class urban person from a prosperous Kathiawadi family take up the cause of a simple wooden gadget on which cotton yarn was spun and which he saw for the first time in Bijapur village in Gujarat in 1917, when he was 48 years old?

But with his sharp insight into the Indian village life, Gandhi was quick to figure out that cotton yarn spinning, as part of making cotton cloth, was key to the self-sufficiency of the Indian village as it employed millions of people and was one in which no other country could match India’s strength.

This is what he writes in his weekly paper *Harijan* in 1940:

YouTube lecture link: https://www.youtube.com/watch?v=Epq_V0mWZNc

“The spinning wheel represents to me the hope of the masses. The masses lost their freedom, such as it was, with the loss of the Charkha. The Charkha supplemented the agriculture of the villagers and gave it dignity. It was the friend and the solace of the widow. It kept the villagers from idleness. For, the Charkha included all the anterior and posterior industries - ginning, carding, warping, sizing, dyeing and weaving. These in their turn kept the village carpenter and the blacksmith busy. The Charkha enabled the seven hundred thousand villages to become self contained.”*

Cotton cloth has been made in India for around five thousand years. Since at least the time of the Roman Empire there had been a demand for Indian cotton fabrics in Europe; these were exported from India in great quantities until the nineteenth century. But it was a one-way trade since there was nothing the West produced that Indians wanted in return, so India had to be paid in gold and silver, creating balance-of-payments problems for even the mighty Roman Empire. Pliny, the Roman historian of the 1st century A.D., calculated the value of the cotton textile trade between India and Rome as one hundred million sesterces [equal to 15 million rupees back then] every year and he complained that India was draining Rome of gold.

The gold and silver that poured into India went into the hands of millions of farmers who grew the cotton, millions of women who spun the yarn and millions of weavers who wove the cloth. It was certainly the world's largest-manufactured trade item of pre-industrial times. Indian cotton cloth, paid for in gold and silver, was arguably the source of India's fabled wealth. People marvelled not just the quantity but at the quality and variety of Indian cotton fabrics. Suleiman, an Arab trader who visited Calicut in 851 A.D., wrote in his diary that “garments are made in so extraordinary a manner that nowhere else are the like to be seen. These garments are wove to that degree of fineness that they may be drawn through a ring of middling size”. Tome Pires, a Portuguese traveller of the 16th century wrote in 1515 from Malacca describing the ships that went there from Gujarat and the Coromandel Coast as being “worth eighty to ninety thousand cruzados, carrying cloth of thirty different sorts”. A hundred years later, French mariner Pyrard de Laval said that Indian fabrics clothed “everyone from the Cape of Good Hope to China, man and woman... from head to foot”.

It was not just fine cloth that India exported; excavations in Egypt of pieces of cloth dating from the 5th to 14th century A.D. have brought to light the ordinary cloth that India made for ordinary people. This kind of cloth was also exported and samples can be seen today in the Newberry Collection housed at the Ashmolean Museum at Oxford.

*Harijan, 13-4-1940

Different regions of the Indian subcontinent, with their specific soils and micro-climates, nurtured different varieties of the cotton plant, each adapted to its local conditions. Farmers used the best of their own seeds for the following year's planting, so that over the centuries each variety of cotton plant was constantly refined and improved while retaining its distinctive character.

Cotton seeds were separated from lint by hand on small household gins in the farmer's house and the best ones were stored for following year's planting. Cotton lint was spun into yarn on household charkhas, producing the variety of yarns that gave Indian fabrics their fabled diversity. There was a charkha in every household, rich or poor. For the poor folk, spinning was livelihood; for the rich, it was a leisure pastime. Dhunkars walked the streets twanging their carding bows, waiting to be called in by household spinners to make their ginned cotton lint into slivers.

This idyllic picture was disrupted by the Industrial Revolution in England. The first machines of the Industrial Revolution were spinning machines and they ushered in the age of mass production. The first spinning mill was set up in England in the late 18th century, followed by many others. The mills needed large quantities of cotton as raw material and Indian cotton became a commodity for export rather than raw material for small-scale local weaving. Household ginning was no longer adequate to gin the large quantities in a short time that export production required, and so large ginning machines were introduced into cotton-growing areas. In these large ginning machines the seeds of the different varieties of cotton, which had been so carefully kept separate for centuries, were all mixed together. The *desi* varieties that were carefully cultivated over the ages became mongrelised, dealing a mortal blow to the legendary diversity of Indian cottons.

The English spinning mills began turning out huge quantities of yarn. And who was to buy these huge quantities of mill-spun yarn? The weavers of India, of course! Mill-spun cotton yarn began to be exported from England to India, destroying the livelihoods of millions of Indian spinners.

Here is an extract from a letter written in 1828 and printed in the newspaper *Samachar* by one such unfortunate person. This is what she says:

"When my age was five and a half *gandas* [a *ganda* is 4 years so she would have been 22] I became a widow with three daughters. My husband left nothing at the time of his death wherewith to maintain my old father- and-mother-in-law and three daughters. . . At last as we were on the verge of starvation God showed me a way by which we could save ourselves. I began to spin on takli and charkha. In the morning I used to do the usual work of cleaning the household and then sit at the charkha till noon, and after cooking and feeding the old parents and daughters I would have

my fill and sit spinning fine yarn on the takli. Thus I used to spin about a *tola*. The weavers used to visit our houses and buy the charkha yarn at three tolas per rupee. Whatever amount I wanted as advance from the weavers, I could get for the asking. This saved us from cares about food and cloth.

“In a few years’ time I got together seven *ganda* rupees. With this I married one daughter. And in the same way all three daughters. There was no departure from the caste customs. Nobody looked down upon these daughters because I gave all concerned, what was due to them. When my father-in-law died I spent eleven *ganda* rupees on his *shraddha*. This money was lent to me by the weavers which I repaid in a year and a half. . . . And all this through the grace of the charkha.

“Now for 3 years we two women, mother-in-law and I, are in want of food. The weavers do not call at the house for buying yarn. Not only this, if the yarn is sent to the market, it is not sold even at one-fourth the old prices. I do not know how it happened. I asked many about it. They say that *bilati* yarn is being largely imported. The weavers buy that yarn and weave. I had a sense of pride that *bilati* yarn could not be equal to my yarn, but when I got *bilati* yarn I saw that it was better than my yarn. I heard that its price is Rs. 3 or Rs. 4 per seer. [She sees that even though the yarn is smoother it is also cheaper.]

“I beat my brow and said, ‘Oh God, there are sisters more distressed even than I. I had thought that all men of *Bilat* were rich, but now I see that there are women there who are poorer than I’. I fully realized the poverty which induced those poor women to spin. They have sent the product of so much toil out here because they could not sell it there. It would have been something if they were sold here at good prices. But it has brought our ruin only. Men cannot use the cloth out of this yarn even for two months; it rots away. I therefore entreat the spinners over there that, if they will consider this representation, they will be able to judge whether it is fair to send yarn here or not”.

The letter was reprinted by Gandhi in the journal *Young India* in 1931.

It was the arrogance of Imperialism that allowed yarn manufactured in England from cotton grown by slaves a thousand miles away in America, to be sold in markets further thousands of miles away, in India, undercutting local manufacture. Gandhi’s perfectly tuned intuition grasped this and made the charkha the symbol of the antithesis of Imperialism – Swaraj.

An opportunity for change came when India threw off the Colonial yoke and became independent. Independence from Colonial rule provided a chance for the country to get rid of the Colonial spinning technology it was burdened with. If Gandhi’s ideas on yarn spinning had been considered at this seminal moment, perhaps India

could have achieved this, but this was not to be – his ideas were rejected outright by fellow patriots.

For instance, Jawaharlal Nehru and scientist Meghnad Saha, unfortunately, did not engage with Gandhi's ideas and instead brushed them aside on the grounds that he advocated a return to, in Saha's words, an "old world ideology" that was to be discarded in favour of modern science and technology. Tagore repeatedly warned of the oversimplification he considered inherent in Gandhi's call for all to spin: "It is essential that the responsibility of swaraj should be accepted fully", he said, "and not as a matter of homespun yarn alone". In fact, Tagore famously dismissed the charkha as a distraction from "our task of all-round reconstruction", while the All India Congress, with Nehru at its head, disowned it.

As to Gandhi's companions, they unquestioningly accepted his ideas but none of them took up a deep study into the relation between the cotton plant and the spinning process.

Perhaps if Gandhi's life had not been so tragically cut short soon after India's independence, he would have looked deeper into the process of yarn-making. Perhaps, he would have pointed Maganlal, his research-minded nephew, towards developing a spinning technology that could innovate machines that used the principle of hand-spinning to produce the vast quantities of yarn that the millions of hand weavers of the day needed. It could have been done with persistence and belief in the importance of yarn-spinning, but instead independent India chose to retain the spinning technology introduced by the East India Company. This meant that if our indigenous cottons – the *herbaceum* and *arboreum* varieties of *Gossypium* plant – did not produce the long, strong cotton fibre this technology demanded, then they must be abandoned in favour of the foreign varieties – the American and Egyptian *hirsutum* and *barbadense*.

In other words, the demands of the machine began to dictate what nature should produce.

A change of cotton varieties meant a change of the whole ecosystem in which they were grown. While the desi varieties had been grown as rain-fed crops, the American varieties needed irrigation – a major change with three results. First, it added huge irrigation costs to the expenditure that farmers had to incur. Second, it depleted precious ground water. And third, it increased humidity in the cotton fields. A humid climate encourages pests and in irrigated fields they increased by leaps and bounds. More technology was then introduced to control pests, laying the path for genetically modified cotton, where a gene of the bacterium *Bacillus thuringiensis* is introduced into the cotton seed resulting in the BT cotton that is in use now.

It is in the specific instance of the introduction of foreign varieties of cotton to

suit an alien spinning technology that I particularly miss the presence of Gandhian thought.

Newly independent India should have framed science and technology policies for specific Indian circumstances and the strengths of the Indian samaaj. If technology development had been in the hands of Gandhi and his followers, they would have come up with a spinning technology which could handle the different varieties of cotton that grew in different regions of the country – as our hand-spinning and hand-weaving technologies were designed to do. The Gandhian way would have been to reject a spinning technology unsuited to desi cotton varieties and to handling diversity. Perhaps then we could have avoided the replacement of our indigenous cotton varieties with American, which have brought so much despair to Indian cotton farmers that lakhs have committed suicide. These were part of what P. Sainath, chronicler of rural India, calls “the largest wave of suicides in history”.

I myself have been involved with cotton yarn spinning for many years and at this point I would like to share with you a brief insight into what we call the Malkha Initiative, in which some steps have been taken towards making yarn on a small scale suited to the small scales of cotton-growing and hand-weaving, what Gandhi referred to as “the anterior and posterior industries”. Malkha spinning units have a hundred times fewer spindles than commercial mills (400 compared to 40,000) and they produce a hundred times less yarn (40 kilos) per 8-hour shift, enough for 40 hand weavers.[†]

Here are a few slides that show how the Malkha units work:

1. The first difference between Malkha and mainstream yarn-spinning is that Malkha starts with “unbaled” cotton lint rather than the lint that has been steam-pressed into blocks known as “bales”.



Figure 7.1 : *Unbaled lint.*

[†]Counterpunch, February 12 2009.

2. In the Malkha unit, this unbaled lint is first fed into a “carder”.



Figure 7.2 : Lint fed into carder.

3. The carder produces what is known as “carded sliver”. The carded sliver then goes through various stages, as shown in the following two pictures.



Figure 7.3 : Carded sliver.

4. Several strands of carded sliver are mixed and drawn down, i.e. made thinner into “drawn sliver”, using the “draw-frame”. After going through further drawing stages, it becomes yarn.



Figure 7.4 : Malkha draw-frame.



Figure 7.5 : Yarn.

5. And finally the yarn is wound into hanks. The hanks of Malkha yarn are more uneven than mill-spun yarn. Though that makes it a bit harder to weave, the gentle way in which it is treated, particularly the elimination of baling and bale-opening, is what gives Malkha fabric its distinctive quality. It is softer and more durable than mill-spun yarn, and takes colour better.



Figure 7.6 : Hanks of Malkha yarn.

6. In the last stage, the yarn, now wound onto warp and weft bobbins, reaches the loom.



Figure 7.7 : On the loom.

While Gandhi was supremely confident of India's ability to take a path to the future based on its own civilisational values and suited to its own circumstances, the new rulers of independent India preferred instead to follow the direction of its erstwhile Colonial masters. They felt that the science and technology developed in the

West was best for India. They thought that India's historical mastery of cotton cloth-making was irrelevant in the modern world and that in this modern world small-scale, decentralised hand-production must be replaced by mass production in large, centralised, energy-intensive mills and factories. Mass production, they thought, would increase India's material wealth and the well-being of the country.

They were wrong.

Seventy-five years after the independence, India lags behind in providing food, health and education to a large number of people in the country. (We see the deficiencies of our healthcare system particularly in these COVID times.)

Inequality between the rich and the poor has reached stratospheric levels, with the richest 10% holding 77% of the country's wealth, while the poorest suffer from poverty similar to that in the countries of sub-Saharan Africa, as Jean Dreze and Amartya Sen point out in their book *India and its Contradictions*. And, of course, the country's wealth is increasing at the cost of exploitation of natural resources for industrial production. The profits made through that exploitation of natural resources are accumulated by those who control that industrial production while the costs of the destruction are borne disproportionately by the poor. Cutting down of forests to build highways and building of big dams to generate energy have benefited big industry while destroying local environments and disabling local industries that have, for ages, used resources of the forests and rivers without causing them harm. For example, look at how river waters were used for centuries. Local dyers such as the kalamkari hand-painters of Kalahasti and the indigo dyers of Ilkal attributed the brightness of their colours to the flowing water of local rivers and streams: "The water of Hirehalla nala was what gave our indigo dyeing its sheen",[‡] says one of the dyers of Ilkal. These waters no longer flow; they've been dammed upstream to generate electricity for big industries. Indigo dyeing has been given up altogether in Ilkal while the artists of Kalahasti have ironically resorted to the water being pumped into fields for irrigation to wash their paintings.

There are other ways in which the rights of villages were breached by Colonial administrators and these have not yet been restored by the rulers of independent India. Activities in the village that were the prerogative of local communities were snatched from their hands by Colonial administrators. For example, fishing in local village ponds was a right allocated to local fishermen, but during Colonial times it was sold to the highest bidder. Bamboo from the forests, from which local bamboo artisans made things of use in the village, was now sold to be pulped for paper in large paper

[‡]Personal communication, Ilkal dyer, 7.3.2007

mills set up in the Colonial days. Similar fates befell the collectors of minor forest produce as well as to the tappers of toddy trees and to sea-side salt-makers.

As artisanal industries declined, the village – as a community of people providing their skills to an interdependent village economy, an economy firmly rooted in its specific place – now turned into a collection of individuals with no professional relation to each other and no reason to remain where they were. They became rootless, a supply of cannon-fodder for the new mass-production industries that sprang up in urban centres far from their village homes. These new industries were structured around the technology of machinery, creating what 20th century French philosopher Jacques Ellul called, “an artificial world and hence radically different from the natural world”. Tools were no longer made to serve humanity; now humanity was servicing the needs of the machine.

This is the direction of technology development that India continues to follow till date. In the view of the vast majority of 20th century Westernised Indian elite, the dominant position of Newtonian science is unquestioned. It seems as though “science” is synonymous with modernity and progress, and under its banner it is possible to dub traditions as superstitions and to consign whole cultures to the dustbin of the unscientific. State policies devalue the knowledge of weaving communities, imposing alien technologies among skilled weaver communities that they have designated as primitive, such as the recent effort to introduce jacquard weaving on frame looms among the loin loom-weavers of Northeast India. If Gandhi’s views, however, had steered India’s technology development, it would have been in the direction of flexibility rather than the uniformity necessary for mass-production. We would have a plethora of flexible technologies that would adapt to the diversity of this vast sub-continent, as traditional Indian technologies like the charkha and the handloom are designed to do.

Flexible technology makes spinning of multiple varieties of cotton possible; different kinds of yarn in different regions can be woven into a variety of cloths that reflect the heritage of each region. There is no reason why modern technologies that enhance flexibility cannot be used for this purpose. Modern communication technologies such as social media can break the hold of the monopolistic market that demands large quantities of identical products. Social media can broadcast information about small-scale local markets, where the knowledge of the maker meets the expectation of the user directly, with fair returns for the makers and made-to-order products for the buyers.

In the Indian situation diversity should be seen as an advantage, not a drawback. Diversity is the poetry of India’s cotton cloth, and it begins with the lint of the di-

verse cotton plants and needs spinning technologies suited to each. In our particular circumstances and considering our particular strengths, we should encourage the development of a plethora of spinning technologies suited to spinning a diversity of yarns from a diversity of cotton varieties. We should do away with the dominance of industrial spinning machinery that demands from the farmer the one kind of cotton it can process, and doles out to the weaver the one kind of yarn it can spin.

We should go in the opposite direction to that monoculture. Growers, spinners and weavers of cotton in different regions should develop the technologies that suit them, which would make them confident in their own domains and participants in a network of equals. Technology development should be in the hands of the producers and anchored at the sites of production.

Even in the 21st century, there are still millions of handlooms weaving cloth across India. A textile policy derived from the philosophy of Mohandas Karamchand Gandhi would ensure that India would establish in this country a diverse, producer-owned, ecological industry in which local environments would be respected. The burden on nature would be limited by nature's own boundaries. Subsistence-for-all rather than profit-for-a-few would reign. This would be the true Swaraj in tune with Gandhi's maxim that the "Earth provides enough to satisfy every man's need, but not every man's greed".

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8

SWARAJ IN THE HISTORY OF SCIENCE: THE CONTRIBUTION OF THE GANDHIAN THINKER SHRI DHARAMPAL (1922-2006)¹

IASc-DBT Gandhi Lecture: 6 July 2021

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The Indian Academy of Sciences (together with the Department of Biotechnology) is organising this important lecture series in absolute consonance with the Academy's founder's cherished objective "to uplift the scientific temper and scientific research in our country". And this is – in the Gandhian spirit – all the more so, given that Professor C V Raman, the Academy's founder and Nobel Laureate physicist, had accepted Gandhiji's invitation to be a key advisory board member of the All India Village Industries Association (known by the acronym AIVIA),² founded in Wardha in December 1934, just eight months after the Academy's own foundation. This association with AIVIA, perhaps a lesser-known fact, conspicuously exemplifies Professor Raman's deep and discerning commitment, which he shared with Gandhiji, towards

YouTube lecture link: <https://www.youtube.com/watch?v=aNR0PPmb2Cg>

realising the hallowed objectives of reinvigorating a people's science, as enunciated by the Academy and put into practice by the Mahatma.

Thus, in a nutshell, serendipitously, yet to be sure also purposefully, this Gandhi and Science Lecture Series (87 years after the Academy's foundation) is able to perform the remarkable feat of filling a glaring lacuna in the contemporary scientific, academic and political discourse as well as praxis, namely by contributing – in a two-pronged manner – towards redressing the balance, so to speak, by reinstating the 'missing Gandhi' in India's scientific discourse, and simultaneously, instantiating a 'missing science' in Gandhian studies. Subsequently, it is hoped that the Academy would be in an advantageous position to chart out a new reinvigorated vision for a future India (underscoring people-oriented scientific policies) whose positive impact is bound to have beneficial global repercussions. Indeed, what better tribute can we pay to the Father of our Nation in celebration of his 150th birth anniversary!

After these opening remarks, I would like to submit that the theme of my essay, or at least its central thrust, discussing 'Swaraj in the History of Science', is intertwined ideationally with the aforesaid tribute. But before I start, here is a necessary caveat: I must admit that I am by no means a specialist in science, but rather, being a historian of ideas and socio-cultural studies, I am greatly interested in this field, especially with regard to understanding, in more depth, a Gandhian scientific approach, guided by the work of domain experts.

SHRI DHARAMPAL'S CONTRIBUTION TO INDIA'S HISTORY OF SCIENCE

In particular, it is the historical work of my late father Shri Dharampal, exemplified in his book *Indian Science and Technology in the Eighteenth Century* (published in 1971)³, which shall be this essay's focal point (*Figure 8.1*). Thereby, my aim is, firstly, to highlight Dharampalji's significant contribution to the history of science, as was emphasised both in the book's foreword by Professor D S Kothari, former President of the Indian National Science Academy, as well as in the introduction by the American physicist, Dr. W A Blanpied, champion of science and public policy, and international consultant for the US National Science Foundation.

Above all, and in consonance with this lecture series' overarching topic, I would also like to trace the way in which Dharampalji's research was inspired, subliminally or indeed directly, by Gandhiji's unstinting efforts to regenerate the 'science of villages' in the context of his Constructive Programme, facilitated as it was, in the 1930s and early 40s, through the Gandhi Seva Sangh in Sevagram, which be-

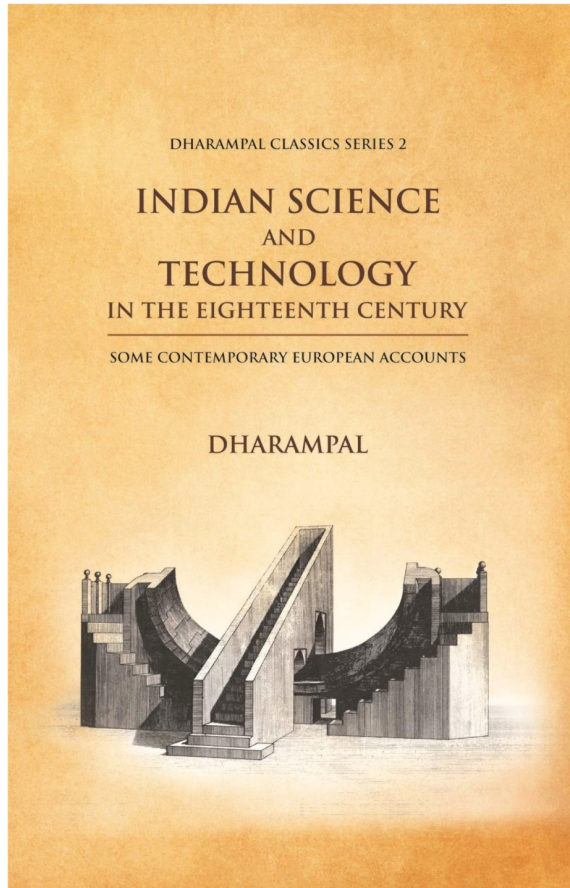


Figure 8.1 : *Dharampalji's book Indian Science and Technology in the Eighteenth Century.*

came Dharampalji's abode and archive from the late 1980s until his passing away in 2006.

In this essay, my endeavour will be to underscore, perhaps more than the factual data, the historical significance and implications of Dharampalji's initiative – and my emphasis is on 'initiative', for his pioneering work was intended to stimulate more extensive research, with the aim of regenerating (and revitalising) India's indigenous praxis of science and technology, so that India's grassroots scientific vitality could ultimately be integrated into the national scientific and technological mainstream.

Serendipitously again, this IASc lecture series coincides with Dharampalji's birth centenary celebrations as well as with the 50th anniversary of the publication of his iconic book *Indian Science and Technology in the Eighteenth Century*, which has been received quite widely – having been reprinted three times, most recently in February 2021 (whose cover is illustrated here).⁴ Therefore, whilst exercising a daughter's privilege, I am, above all, fulfilling my filial debt and responsibility in acknowledging his oeuvre. All the while, it is befitting for me to act as a mouthpiece for the voices of his many former associates who are engaged in taking forward his legacy. In this context, I would like to cite Professor Shambu Prasad, a previous speaker in this lecture series, who stated that "Dharampalji's work on Gandhi and Indian science and technology in the 18th and 19th century have been useful leads for scholars looking at alternative conceptions of S&T in India".⁵ This was indeed the reason for this particular publication's considerable impact for several decades from the 1970s onwards,⁶ for several decades, among successive generations of young IIT (Indian Institute of Technology) scientists and activists.

However, his book's influence can only be appreciated after taking cognisance of the state of knowledge regarding India's history of science in the 1970s and 80s. Fortuitously, since this problematic 'state of the art' is cogently elucidated in a book review published in the *PPST Bulletin*⁷ in 1982, I shall quote directly from it, with the aim to also highlight PPST Foundation's pioneering role in publishing and taking forward Dharampalji's work. The extracted quote from their long book review reads as follows:

"It is generally held that non-western societies, prior to their colonization, either did not have any science or had what can be best described as 'pseudo-science'. A logical corollary of this position is the statement that non-western societies did not have any science-based technologies. If one defines the term science as synonymous with modern Western science and considers any body [i.e. corpus] of systematic knowledge different from it as either unscientific or pseudo-scientific, then, of course, the above propositions are reduced to mere tautologies and there is no sense in asking for confirmation or refutation of these propositions on empirical grounds. One may at best question the semantic appropriateness of equating science with modern western science, drawing attention to the fact that several of the features which are supposed to characterize modern western science are also equally characteristic of non-western knowledge systems.

"However, the statement that non-western societies before their colonization had neither any science nor any science-based technology is never interpreted as a mere definition of science and technology. It is in fact generally understood (and asserted)

as a historical-empirical position. Given the almost universal acceptance of this position, one would think that the evidence in support of it must be overwhelming. However, this position is taken to be so obvious that collecting historical material on the science and technology of the colonized countries just before colonization (around the mid-eighteenth century) is not generally considered a worthwhile task. Hardly any work on the history of these times has been done. Shri Dharampal's book, 'Indian Science and Technology in the Eighteenth Century', is indeed an exception to the general trend, and to some extent breaks this conspiracy of scholarly silence".⁸

It was worth quoting this extract from the much longer review, for the two short paragraphs neatly pinpoint three key arguments: First, the all-pervasive assumption, until the 1970s, regarding the absence of scientific knowledge and practice in pre-colonial India; second, the questioning of the hegemonic definition of science as 'modern Western science'; and third, the compliant and passive position taken by Indian academia in this regard. All three are topics about which volumes have been written, and in the face of which Dharampalji's book provides contestatory historical, empirical evidence.

In recognition of his contestatory and pioneering role, he has been ranked among the founding fathers of science and technology studies in India. Yet, curiously, thanks to his radical dissenting stance, Dharampalji has been categorised as a 'Marxist' in a Wikipedia article⁹ featuring this topic (a misnomer which perhaps also serves to question or even repudiate the merit of labelling per se)!

GANDHIAN IMPETUS TO DHARAMPAL'S SWARAJ INITIATIVES

The rationale for why Dharampalji seriously questioned (or even repudiated) the prevalent post-Independence public discourse, branding 18th century Indian society as being sunk in the dark ages, also needs to be explained:

Primarily, his contestatory spirit was in virtue of his being genuinely 'a child of the Gandhian era' (as elucidated in his lucid book *Understanding Gandhi*¹⁰; Figure 8.2), and his emphatically upholding Gandhiji's belief in the fundamental viability of Indian society (as proclaimed in *Hind Swaraj* [1909]). Further, ideationally enthused by and actively participating in Gandhiji's movement for political Swaraj (after abandoning his B.Sc. in Physics), he contributed zealously towards India achieving her independence; subsequently, post-Partition, through his refugee rehabilitation endeavours together with Dr. Ram Manohar Lohia and Smt. Kamaladevi Chattopadhyaya, as well as his co-founding, with L. C. Jain, the Cottage Industries Emporium – thereby promoting village industries – he was at the forefront of national reconciliation and regeneration, both imbued with Gandhiji's spirit.

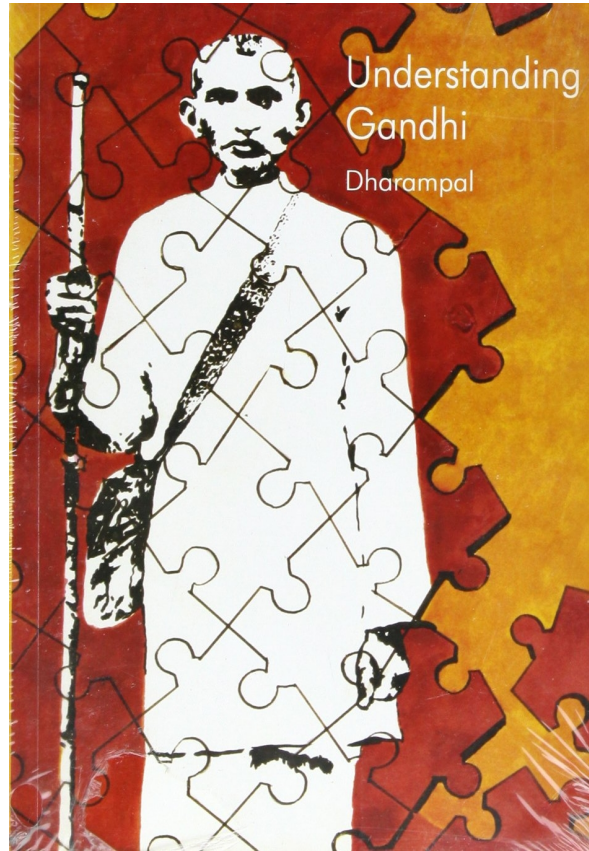


Figure 8.2 : *Gandhi: His Perennial Lodestar.*

Then, he became intensely involved, together with Mirabehn (Gandhiji's British-born disciple), in taking forward Gandhi's vision of *gram swarajya* in establishing the community village of Bapugram near Rishikesh (*Figure 8.3*; details of which I have outlined previously, in particular, in an introduction to his (*Figure 8.4*) *Essential Writings*¹¹). Yet, consequently, disillusioned by the futility of idealistic experiments in rural regeneration, dwarfed as they were by the Nehruvian massive industrialisation agenda¹², and moreover, challenging the much-heralded technocratic planned economy, he was intent on salvaging and reinvigorating (what he considered) the intrinsic ingenuity of India's beleaguered and neglected rural artisan communities, as implicit in his castigation of the status-quo view:



Figure 8.3 : *Dharampalji at Pashulok Ashram, Bapugram, 1950.*

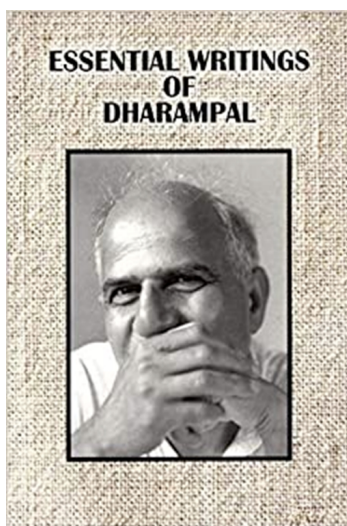


Figure 8.4 : *Essential Writings of Dharampal, Publication Division, Delhi 2015 (for more details, see www.dharampal.net).*

“[...] the people for whom we plan and weave our dreams are seldom anywhere in the picture. More often they are just labourers, wage-earners, with little sense of participation or adventure in the India we plan to reconstruct. The reasons for such apathy are perhaps very deep, somewhere very near the soul of India. Yet that soul has to awaken, before we proceed from dams and steel plants to the flowering of the human being, of the Indian we have deemed to be ignorant, of the people of India whom we describe as ‘teeming millions’ equating them with ant-heaps. Such awakening, however, is not impossible – Gandhiji did it against heavier odds. All of us in a way are heir to Gandhiji, what we lack is proportion and humility”.¹³

Intent on influencing political opinion, Dharampalji sent the article (from which the quote is extracted), entitled ‘A Surfeit of Planning: Where are the People?’, to all members of the Lok Sabha. It also reached E F Schumacher (celebrated author of the bestseller *Small is Beautiful*¹⁴), who used parts of it in a lecture delivered in 1962 at the Gokhale Institute of Economics and Politics, Pune.

Feeling impelled to contribute to this much-needed ‘awakening’ in whatever way he could, Dharampalji realised that in order for the already-attained political Swaraj to facilitate the ‘flowering of the human being’, an intellectual Swaraj or a ‘Swaraj in Ideas’ (as formulated by K C Bhattacharya¹⁵ and inspired by Gandhiji) was essential. Indeed, an ‘intellectual-psychological unburdening of colonial indoctrination’, as Dharampalji termed it, was a matter of urgency, so that, consequently, as envisioned by Gandhiji, Indian societal organisation, its polity as well as its cultural and economic institutions could be regenerated, locally and nationally from within – in consonance with the needs of the people.

Having already appraised remnants of viable precolonial local structures (for instance, through his field investigations into the traditional Panchayats of Rajasthan and Tamil Nadu¹⁶, as the Director of Study and Research of the All India Panchayat Parishad during 1963–1965), Dharampalji realised that these findings were indicative of well-functioning societal mechanisms (operating in the recent past) for maintaining a largely beneficial social and economic equilibrium among diverse local communities. Therefore, according to him, an objective, and a more comprehensive understanding of the detailed functioning of Indian society before the onslaught of colonial rule was a matter of urgency, not only to correct the distorted image of past destitution but – even more crucially, to address his serious concern about the concrete repercussions these assumed ‘degenerate’ conditions in the recent past had in the policy-making of modern India. About this detrimental state of affairs he formulated the following lucid statement:

“This picture usually implied that our village folk and their ancestors had wallowed in misery for a thousand or more years; that they had been terribly oppressed and tyrannised by rulers as well as their social and religious customs since time immemorial; and that all this had mostly left them dumb, or misguided victims of superstition and prejudice. From this we assumed that what we had to deal with was like a blank slate on which we, the architects of the new India, could write, or imprint, what we wished. We seldom thought that these people had any memories, thoughts, preferences, or priorities of their own; and even when we conceded that they might have had some of these, we dismissed these as irrelevant. And when we failed in writing on what we assumed to be a blank slate, or in giving such writing any permanence, we felt unhappy and more often angry with these countrymen of ours [...]”.¹⁷

Resolutely not accepting the modernist developmental notion of the Indian people’s competence representing a ‘blank slate’, he adamantly considered ‘a more exact knowledge of the past’ – in other words, and more specifically, attaining ‘Swaraj in the History of Science’ to be ‘a necessary foundation for future development’.¹⁸

DHARAMPALJI’S ARCHIVAL RESEARCH AND THE QUINTESSENCE OF INDIAN SCIENCE AND TECHNOLOGY IN THE EIGHTEENTH CENTURY (1971)

Then in the mid-1960s, compelled to relocate to London due to his son’s almost-fatal road accident, Dharampalji experienced his *agni-pariksha*, so to speak, by transforming a family tragedy into an opportunity for remapping recent Indian history by unveiling or ‘de-masking’ the British-Indian colonial archive. To explain briefly, as my brother began slowly recovering, my father got involved in meticulous archival research, single-handedly, despite the fact that he had no formal historical training and was supported by no official funding. Yet these substantial logistical inadequacies did not prove to be obstacles or hindrances to the realisation of his Gandhian commitment in his search for truth.

Thus, he began his painstaking excavations – lasting for decades – into early British colonial records (lodged in the London India Office, the British Library and several university collections of the British Isles, which for him constituted the only valuable legacy of the British Raj!), with the ultimate objective of contesting the conventional but hegemonic image of a dysfunctional Indian society at the eve of the British conquest.

But the supreme irony was that he attempted to achieve this contestatory goal by meticulously deconstructing documents generated by early British experts them-

selves in the process of their reconnaissance and subsequent conquest of the sub-continent. Thus, engaging in a variant of Foucault's 'archaeology of knowledge',¹⁹ Dharampalji's archival excavations uncovered a wealth of astounding material that had been considered of significant interest to the 18th and early 19th century British specialists, with a view towards upgrading their own fledgling branches of science and technology. About this European (and in particular, British) 'appropriation' of knowledge, Dharampal elucidates the following:

"Practically all European scientific and technological accounts relating to the sciences and technologies of non-European countries (including the ones reproduced here [i.e. in *Indian Science and Technology*, 1971]) are an outcome of the seventeenth and eighteenth century European quest for usual knowledge in these fields. [...] It is in this context of widening horizons as well as the urgent need for materials and processes (partly resulting from constant warfare in which Europeans were engaged during the greater part of the eighteenth century) that accounts of the kind reproduced here were written and submitted by individual Europeans to their respective patrons. It is in these European writings of the period (i.e. from 1720 to 1820) that one discovers the observed details about science and technology as well as about the societies, institutions, customs and laws of various parts of the non-European world. Before this period, the European ability to comprehend this new world was limited; after about 1820, the knowledge and institutions of the non-European world also began to have much less usefulness to the problems of Europe".²⁰

Hence, besides remapping India's history of science, he was also able to extend Indian horizons; he retraced the outlines of Britain's history of science by providing indications of India's own contribution in this domain. This initiative indeed resembles Donald F Lach's work entitled *Asia in the Making of Europe*,²¹ which reveals the impact of Asia's high civilisations on the development of various dimensions of the modern Western society. However, after the appropriate data had served its specific purpose, this early modern Indian documentary evidence was discarded or disregarded in the construction of the subsequent hegemonic colonial 'history of science' that, in the 1970s, still held sway in mainstream academia.

Propelled by a Gandhian impulse not only in search for truth about the recent past but also intent on bringing about an intellectual Swaraj, this pioneering historian-in-the-making presented a judicious but representative selection of his discoveries in the aforementioned volume.

In *Figure 8.5* is a copy of *Indian Science and Technology in the Eighteenth Century's* list of contents, which provides a thematic documentary overview: Of the seventeen documents, penned by British observers of the subcontinent, and published in

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(Figure 8.5 continued...)

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Figure 8.5 : List of contents of the book *Indian Science and Technology in the Eighteenth Century*.

this book, six deal with striking examples of Indian scientific knowledge (*Figure 8.6*) – so striking that they attracted the attention but no less the consternation of British experts in the field, for they exemplified the Indian facility and proclivity with complex astronomical calculations.²² They also typified phenomenal demonstrations of scientific exactitude as in the edifice of the observatory in Benares,²³ whose construction date, however, became shrouded in ridiculous controversy, due to later British

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Figure 8.6 : *Striking examples of Indian scientific knowledge.*

writers' unwillingness to acknowledge its independent origin prior to contact with European astronomers.²⁴ Another report emblematised discoveries about the sixth satellite of Saturn,²⁵ hitherto unknown to British astronomy. Other reports substantiated advanced achievements in algebra²⁶ and, in particular, Indian proof of the binomial theorem²⁷ prior to Isaac Newton's discovery. These aforementioned reports are noteworthy for two reasons – first, pre-eminently, as incontrovertible evidence of a relatively dynamic scientific climate, still prevailing in late 18th century India, and second, perhaps equally significantly, for shedding light on the wilfully darkened phases of India's scientific history, since these reports also provide testimony for the British observer's inability to concede that (for which I quote one telling instance) "there had arisen a Newton among the Brahmins, to discover that universal principle which connects, not only the most distant regions of space, but the most remote periods of duration".²⁸ Indeed, as Dharampalji perspicaciously (and with Gandhian wit!) elucidates in his explanatory preface, "it became intellectually easier for him [i.e. the British observer, namely John Playfair, professor of mathematics at Edinburgh University] to concede this astronomy's antiquity [i.e. by imputing direct observation in the year 3102 B.C!], rather than its sophistication and the scientific capacities of its underlying theories".²⁹

This dichotomous argument encapsulates, in a nutshell, the Catch-22 dilemma (also involving blasphemy for a Mosaic-Christian belief in the Deluge, computed to

have taken place in the year 2348 B.C., after which date ‘history’ was supposed to have begun³⁰) with which the British scientific establishment was confronted; for as an imperial power-in-the-making, Britain was not able to acknowledge India (on the verge of being conquered) as being scientifically more advanced than the colonial metropolis. However, subsequently, after the 1820s,³¹ India (as we are painfully aware), having become a vanquished and devastated territory, did not pose this problem any longer. Hence, this controversial material became defunct for the general public but was still available in the archives.

But to return to our book’s contents and their brief presentation, the eleven documents in the longer section, devoted to applied scientific technology (*Figure 8.7*),

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XII. Indian Agriculture (cir. 1820)	201
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XIV. Iron Works at Ramanakapettah (AD 1795)	233
XV. The Mode of Manufacturing Iron in Central India (cir. 1829)	237
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Figure 8.7: Section devoted to scientific technology.

highlight the socially and culturally embedded nature of science in true Gandhian fashion. These factual accounts describe a wide variety of implements and practices observed by early British colonists in different regions of the subcontinent, among which figure prominently – in the domain of medical science and especially topical for us now – the age-old practice of smallpox inoculation, carried out efficaciously in Bengal (and most regions of the subcontinent), which entailed an astonishing understanding of bacterial infection whose scientific principles were not grasped by Dr. Holwell, the report's author,³² for both smallpox inoculation and germ theory were still unknown to mid-18th century British medical science. Likewise, the science of plastic surgery performed successfully, as observed, especially in western India, is reported in minute (albeit gory) detail.³³ In the domain of agricultural scientific practice, the use of drill-plough³⁴ and other sophisticated agricultural implements, including irrigation techniques and soil science, are described in avid detail, in particular by Alexander Walker.³⁵ In the field of manufacturing technology, detailed descriptions of making high-quality iron and steel in small moveable furnaces in various parts of India are provided.³⁶ And last but not least, there are discerning explanations of the technique of ice-making in Allahabad and Calcutta,³⁷ that of mortar production in Madras³⁸ and widespread paper-making from *son* plants.³⁹

Accompanying many of these detailed accounts (originally intended for a British scientific readership and sometimes even presented to parliamentary committees) are intricate diagrams of the exact construction of the observed apparatus.

Here are just a couple of examples detailing, first, the construction of a smelting furnace (*Figure 8.8*), the main part of which could, according to the author, be set up in half an hour.⁴⁰ Second, *Figure 8.9* shows a varied assortment of instruments used in making paper.⁴¹ These intricate diagrams themselves (along with many others accompanying the textual reports⁴²) would seem to be indicative of the observed scientific technologies' subsequent appropriation, and further development in accordance with British scientific and industrial requirements at the turn of the 19th century.

CRUCIAL OBJECTIVES OF DHARAMPAL'S PIONEERING GROUND-WORK

After this brief overview of empirical data, without going into a detailed examination of the individual documents providing invaluable insights into the late 18th century praxis of India's science and technology as observed by early modern British experts, in the interest of brevity (and lacking in the necessary scientific expertise), I shall restrict myself to some crucial comments:

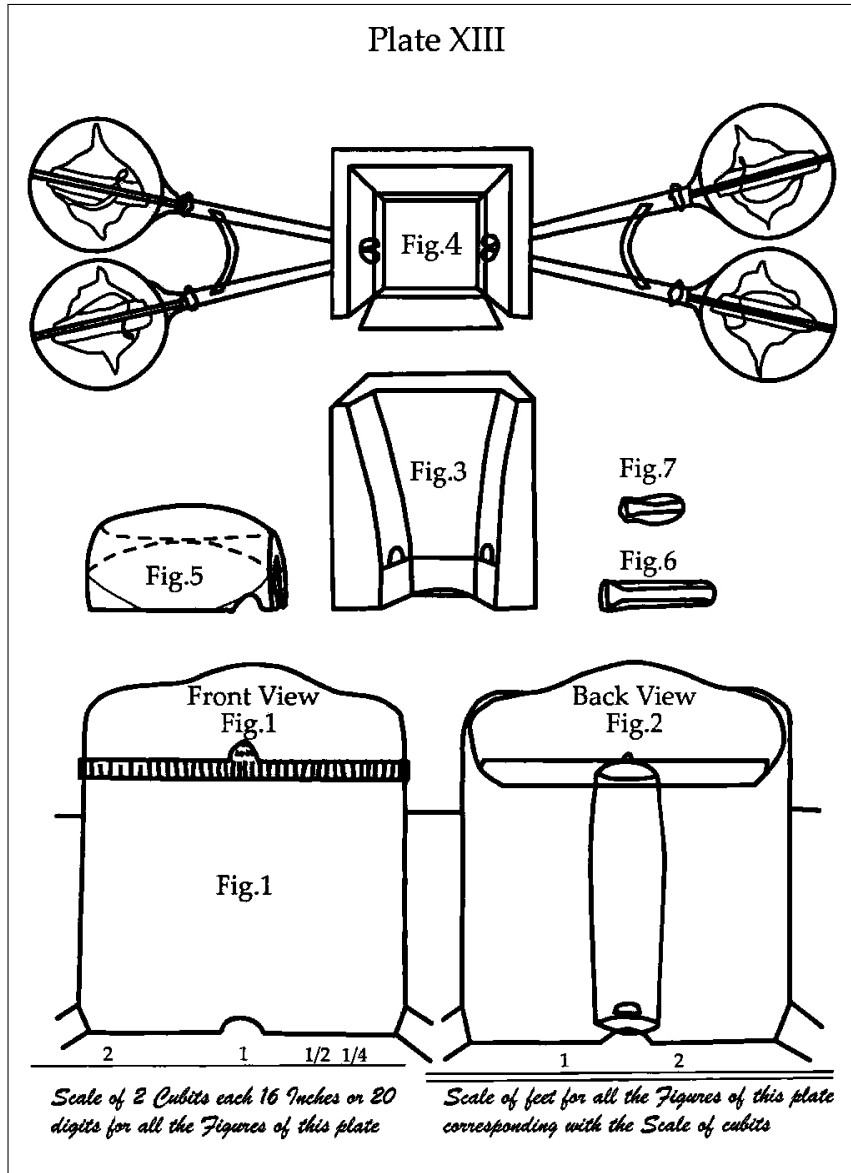


Figure 8.8 : Smelting furnace.

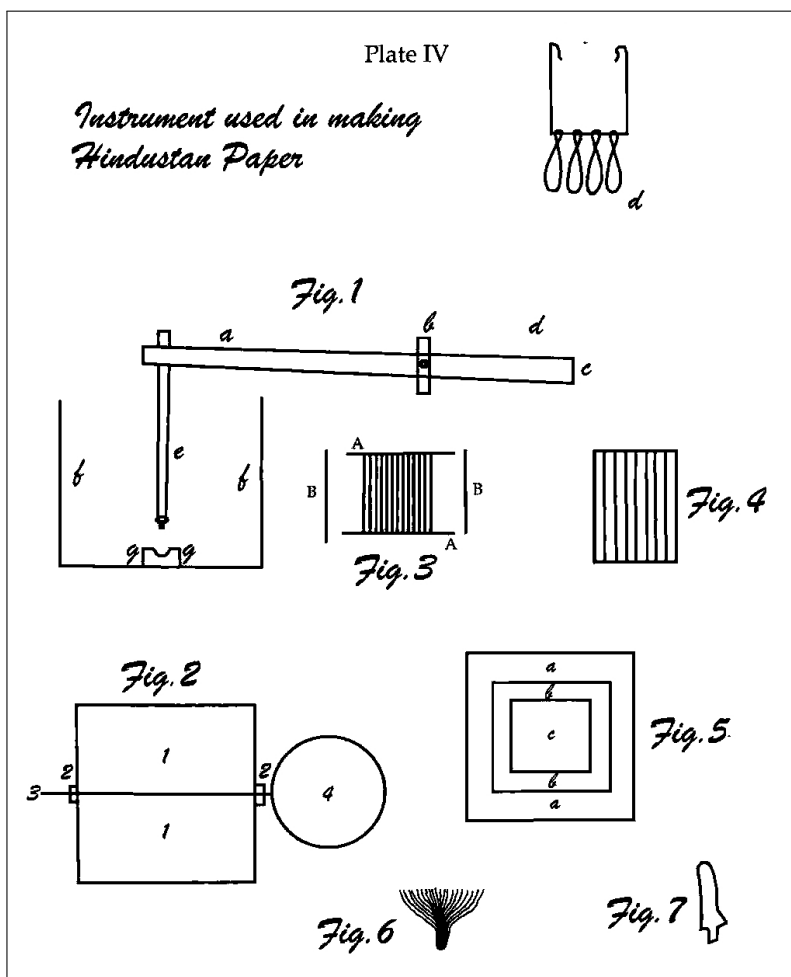


Figure 8.9: Instruments used in making Hindustan paper.

First, the publication of this selective documentary evidence of the relatively high level of Indian scientific and technological achievements in the 18th and early 19th centuries not only contributed to a more accurate appreciation of India's recent history of science but in addition, given that much of this material was relatively accessible to scholars in published form or in archival collections, it was amazing that this documentation had not been taken into consideration by specialised Indian historians of science. Therefore, it was indeed Dharampalji's research that signalled the urgent

need for launching a more concerted effort on a national scale to bring about a change in the colonial mindset by stimulating creativity and independent research, which (according to him) was essential to facilitate a comprehensive Swaraj in India's history of science.

Second, in initiating this large-scale research, Dharampalji's objective was to substantially enrich India's historiography of science, and he hoped that this nationally conducted investigation would be supported by government funds and would comprise more extensive forays into British and other European archival holdings. Third, even more crucially, the objective of this research should be to bring to light indigenous regional testimonies from varying sources, of written, oral and inscriptional provenance. Above all, he lay emphasis upon India's scientific community taking cognisance of the grassroots' people's science, both past and present, which, fortunately, became the prime focus of the PPST's Congresses, held in the 1990s.⁴³

Fourth, one of the substantial scholarly outcomes he had in mind was an Indian pendant to the monumental project initiated by Joseph Needham (in 1954 and still ongoing) on the *History of Science and Technology in China*.⁴⁴ Although some attempts in this direction have been made in India during the intervening five decades (supported also by the Academy and allied scientific institutions⁴⁵), more incisive research remains a desideratum, so that we can obtain a more nuanced understanding of India's traditional synergetic relationship between science and society.

In point of fact, the documentary evidence retrieved by Dharampalji bore concrete testimony to the socially and culturally embedded nature of scientific knowledge and practice. He elucidated this lucidly in the book's preface, after having pointed out the diametrical variance between early modern British and Indian social-political structures, as follows:

"Consequently, the sciences and technologies of the non-European world also had different seekings and developments to those of Europe. Further, in countries like India, their organisation was in tune with their more decentralist politics and there was no seeking to make their tools and work places unnecessarily gigantic and grandiose. Smallness and simplicity of construction, as of the [moveable] iron and steel furnaces [numbering up to 10,000 with each producing 20 tons annually] or of the drill-ploughs, was in fact due to social and political maturity as well as arising from an understanding of the principles and processes involved. Instead of being crude, the processes and tools of eighteenth century India appear to have developed from a great deal of sophistication in theory and a heightened sense of the aesthetic".⁴⁶

Needless to say, impacting scientific and economic policy-making was also Dharampalji's ulterior aim in publishing this documentary evidence. For, not only did it

testify to the relatively high level of Indian scientific and technological achievements in the 18th century, but also to their socio-cultural and economic appropriateness and suitability for India's population as a whole. Thereby, this historical data was a concrete exemplification of Gandhian scientific and economic ethics, defined as they were by democratic and humanitarian principles. In short, with this validation, Dharampalji's ambitious mission was to initiate a paradigm shift in India's modernisation agenda.

This needs to be spelled out briefly: according to him, the still-existing indigenous expertise (albeit in a debilitated state) needed to be taken into serious consideration, with concerted efforts made to regenerate and reintegrate it into mainstream science and technology, in order to stimulate innovation and creativity – inspired by the grassroots – in the ongoing developmental enterprise. He expressed this repeatedly on many occasions, of which the following quote (from a lecture delivered at Calcutta's Birla Industrial and Technological Museum, in October 1986) is just an example:

“Our essential task is to bring back the innovative and technological skills of our people, those who professed them for millennia and until at least 1800, to the rebuilding of our primary economy and industry. [...] One of the causes of our failure [after Independence] may be that we attempted the creation of a new economy and industry largely on poor uncomprehending imitation and with the help of talent which was drawn from no more than two percent of our people”.⁴⁷

IN CONCLUSION: WHERE DO WE GO FROM HERE?

In an open-ended conclusion to my essay, I should like to make a few observations, which may also have a bearing on the present.

Admittedly, the aforementioned atrociously undemocratic selection (namely, 2% from the vast pool of the subcontinent's talent) represented for Dharampalji a horrendous wastage of India's scientific potential. This was even more pertinently the case, especially in view of his excavated historical data testifying to the fact that, traditionally, unskilled labour did not exist in Indian society where everybody in fact exercised a skill of some kind.

In order to recalibrate this terribly skewed situation, according to him, first, Swaraj in the history of science needed to be supplemented and synergised, first and foremost, with a Swaraj in our social, economic and political history – with the objective of investigating the causes and mechanisms by which, not only this people's knowledge (*lok vidya*) had been discarded and then fallen into oblivion, but also, concomitantly, the processes by which the relevant institutions had become defunct. To obtain any vi-

able understanding would, he explained, entail in-depth research into socio-economic interventions (such as the exploitative taxation that sapped the local resource base⁴⁸), as well as political and ideological impinging factors, subsequent to the advent of colonial rule.⁴⁹

Second, intent on evaluating, impartially, the social–historical significance of his findings, he opined that fundamental insights would not necessarily be obtained by juxtaposing India in competitive comparison to Europe. That is, rather than merely emphasising that India produced better steel, practised more sophisticated medicine, provided better education for her children before the onset of colonial rule than either her counterparts in contemporary Europe or, 50–100 years later, on the subcontinent itself, in consonance with his scholarly approach it would be far more worthwhile to investigate how the attainment of this relatively high level of civilisational achievement had indeed been possible. This discerning appreciation, he insisted, could only be achieved by becoming familiarised with the complex societal, economic and cultural mechanisms that had facilitated these accomplishments.

Third, obviously the attainment of this much-needed, in-depth understanding would entail doing detailed research into the functioning of Indian localities and their communities, their socio-economic infrastructure and instrumentalities. His own insights gained from a close analysis of early British-Indian historical documentation (especially with regard to the Chinglepet district of Tamil Nadu, near Chennai⁵⁰) seemed to indicate that traditional Indian society and polity, as intuitively understood by Gandhiji, was defined not so much by categories of hierarchy and political asymmetries, but rather by those of mutual relationships, which may possibly have been of a competitive nature but not necessarily of a suppressive subjugating one.⁵¹ As for the categories of hierarchy and political asymmetries, in his many articles and talks, Dharampalji has shown how these factors had become accentuated as a result of the British–Indian encounter, extending over one and a half centuries.⁵²

Whilst taking a cue from these guidelines for conducting comprehensive research in the social sciences, we simultaneously need to reflect on fundamental questions, inspired by Gandhiji and articulated by Dharampalji, of the science–society nexus, so that the practice of science and technology becomes more responsive to the needs and preferences of Indian society as a whole. This approach is even more urgent now when the infallibility of modern science (that Gandhiji questioned in the first half of the 20th century) is being challenged more than ever in the first decades of the 21st century.

Needless to say, the COVID-19 pandemic has exposed major faultlines and fragilities in our current systems. Whilst acknowledging the prevalent inadequacies and in-



Figure 8.10: *Dharampalji in 1983 with the Collected Works of Mahatma Gandhi.*

justices, it must also be realised that mainstream development thinking and practice are part of the problem. Transformations are needed (besides in our economy and governance) also in our science policies whereby our efforts should be focussed on improving policies that affect science, i.e. policy for science, as well as on improving policies that can benefit from scientific understanding, i.e. science for policy. Indeed, post-COVID-19, development must have radically transformative, egalitarian, and inclusive knowledge and practice at its core, in which taking cognisance of past trajectories of India's pluralistic and socially embedded science and technology can provide inspiration, if not practical answers, for tackling our ongoing problems. This would indeed be an appropriate way of realising Gandhiji's vision for 'Science and the Future of Humanity', a trajectory for which Dharampalji's work has contributed a much-needed stepping stone (*Figure 8.10*).

NOTES

1. This constitutes a slightly revised version of the online talk given on 6 July 2021, whereby references and additional explanatory information have been included in the endnotes, to provide a more substantial overview. Moreover, the appendix comprises historical empirical and illustrative data of interest, especially for experts in the field. I should like to express my grateful appreciation to the Indian Academy of Sciences, Bangalore, and especially to its President Professor Partha Majumder, for graciously inviting me to give a keynote talk in the Academy's ongoing Gandhi Science lecture series on "Science and the Future of Humanity". Also, given that this lecture series is closely related to the ICSSR major research project that I am conducting on Gandhiji's Constructive Programme (its historical and contemporary relevance), I should like to acknowledge my gratitude to the ICSSR for its generous support in this regard.
2. Gandhiji was President of the AIVIA, with the economist J C Kumarappa as Secretary, and two other national celebrities, besides C V Raman, were Advisory Board members, namely P C Ray and Rabindranath Tagore.
3. With the subtitle *Some Contemporary European Accounts*. Delhi: Impex India, 1971.
4. Reprinted as part of the *Dharampal Classics Series* and edited by J K Bajaj and M D Srinivas, Vol. 2, Bengaluru: Rashtrarthana Sahitya and Chennai: Centre for Policy, 2021. The volume also forms part of *Dharampal: Collected Writings*, 5 volumes, Mapusa: Other India Press, 2000, Vol. 1, reissued in 2003 and 2007; in addition, it has been integrated in the Gujarati and Hindi translations of *Dharampal Samagra Lekhan*, 11 and 10 volumes, respectively, edited by Indumati Katdare, Ahmedabad: Punarutthan Trust, 2005 and 2007. Lastly, the book was translated into Tamil by B R Mahadevan as *Azhagiya nathi, pathinettam Nootrandil India winyanamum thozhilnut-pamum*. Chennai: Kizhakku pathipagam, 2019.
5. C Shambu Prasad: "Revisiting Dharampal: Reflections on history of technology in contemporary India", paper for *ENGAGING WITH INDIAN CIVILIZATION: Seminar in remembrance of historian & philosopher Dharampal*, CSDS, Delhi, 10 February 2007.
6. In November 1971 itself, a national seminar was chaired by Prof. D S Kothari, at the initiative of Shri Jayaprakash Narayan, in Delhi on "Science, Technology and Society in Eighteenth Century India" with the aim of initiating further research.
7. PPST is an acronym for the Foundation promoting "Patriotic and People-oriented

Science and Technology” of which Dharampal was elected first President in 1986, and many of his articles were published in the *PPST Bulletin*; for details, see their current website: <https://www.ppstindiagroup.in>.

8. Extract from the review on Dharampal’s *Indian Science and Technology in the Eighteenth Century. Some Contemporary European Accounts* (Delhi: Impex India, 1971), in: *PPST Bulletin*, Vol. 2, no. 1, March 1982; to read the much longer complete review and for more details, please consult the PPST Archives at: <https://www.ppstindiagroup.in>
9. See https://en.wikipedia.org/wiki/Science_and_technology_studies_in_India
10. *Understanding Gandhi*, Mapusa: Other India Press, 2003; a Tamil translation, by Janakipriyan, was published as *Gandhiyai aridal*, Nagercoil: Kalachuvadu Pathipagam, 2010. That Gandhiji became his lodestar is rendered explicit in his own words: “My first glimpse of Mahatma Gandhi was in December 1929 at the Lahore Session of the Indian National Congress. I had gone there with my father who – like thousands of other young people at the call of Mahatma Gandhi – had abandoned his university education. Those were days of great excitement for me and many of my age (I was barely eight!).” *ibid*, p. 1.
11. *Essential Writings of Dharampal*, edited by Gita Dharampal, Delhi: Publications Division, Government of India, 2015, Introduction, pp. 1–30; for further biographical details, see, in the same volume, also Dharampal’s Life and Work: A Chronology, pp. 379–384, and for a consolidated list of his writings, Dharampal’s Bibliography, pp. 385–396.
12. Also due to the failure of the Constitution to incorporate indigenous administrative and political structures (except for mentioning them briefly in the Directive Principles) which Dharampal highlighted in his publication *Panchayat Raj as the Basis of Indian Polity: An Exploration into the Proceedings of the Constituent Assembly*, AVARD: New Delhi, 1962. This failure, according to him, had contributed towards incapacitating rural Indians from participating in the mainstream of post-independence India.
13. “A Surfeit of Planning: Where are the People?”, *AVARD Newsletter*, New Delhi, July–August 1960, republished in: Dharampal, *Rediscovering India. Collection of Essays and Speeches (1956–1998)*, SIDH: Mussoorie, 2003, pp. 129–131, quoted phrase on p. 130.

14. *Small Is Beautiful: A Study of Economics As If People Mattered* is a collection of essays published in 1973 by German-born British economist E F Schumacher.
15. Krishna Chandra Bhattacharyya's 1928 talk entitled "Swaraj in Ideas", given to students in colonial Calcutta, discusses how essential it is to free oneself from the paralysing burden of intellectual and cultural subjection.
16. Such as the *bees-biswas* panchayat (village council of 20 parts) which was still (in the early 1960s) partially operative in some villages of Rajasthan, as well as the organisation of Tamil rural communities as *samudayam* villages in which individual shares in the cultivable land were redistributed periodically (a practice known as *kareiyeeedu*) in order to maintain a degree of equity of livelihood among all members of the village community; according to local reports, *samudayam* villages had still been in existence in the 1930s; and British revenue surveys from the late 18th century mentioned that 30% of all villages in the Thanjavur district were of the *samudayam* type.
17. Extract from Dharampal: "Some Aspects of Earlier Indian Society and Polity and their Relevance to the Present", a series of three lectures delivered on 4–6 January 1986, Pune, published in *New Quest*, 1987, Nos. 56, 57 and 58, republished in: *Essays on Tradition, Recovery and Freedom*, Vol. V of *Dharampal, Collected Writings*, 5 volumes, Other India Press and SIDH: Mapusa, Goa, 2000, rep. 2003, 2007, pp. 1–49; also in *Essential Writings*, Delhi 2015, pp. 31–81; also translated into Hindi, Marathi and Tamil.
18. Quoted extract from an unpublished note, "The Problem of Apathy: An Enquiry into the Beginning of British Rule", written in March 1965, p. 12.
19. As elaborated in the iconic work by Michel Foucault, *L'archéologie du savoir* [*The Archaeology of Knowledge*] (1969).
20. Quoted from Dharampal's Preface to *Indian Science and Technology in the Eighteenth Century* (1971, reprinted edition, 2021), p. 4f.
21. Donald F Lach, *Asia in the Making of Europe*. Chicago University Press, 1965–1993, 3 volumes in 9 books. The third volume was co-written with a colleague and former student, Edwin J Van Kley. The whole series has been described as a "masterwork of scholarship".
22. See, in particular, the substantial document "II. Remarks on the Astronomy of the Brahmins (AD 1790)" by John Playfair, A.M., F.R.S., published in Edinburgh 1790, reprinted in *Indian Science and Technology*, op. cit., pp. 56–106.

23. See the historical document “I. Bramin’s Observatory at Benares (AD 1777)” by Sir Robert Barker, F.R.S., published in 1777, reprinted in *ibid*, pp. 43–55.
24. For details regarding the controversy of the observatory’s construction date, see the historical document “III. Hints concerning the Observatory at Benares (cir. 1783)” by Reuben Burrow, reprinted in *ibid*, pp. 107–121.
25. For details, see the historical document: “IV. On the Sixth Satellite of Saturn (AD 1783)” by Col. T. D. Pearse to Secretary, Royal Society, London, dated Madras, 22 September 1783, reproduced in *ibid*, pp. 122–127.
26. For details, see the historical document: “VI. Hindu Algebra (AD 1817)”, by H.T. Colebrooke, extracted from the *Dissertation on Algebra with Arithmetic and Mensuration, from the Sanscrit of Brahme Gupta and Bhascara*, London 1817, reprinted in *ibid*, pp. 136–164.
27. For details, see the historical document: “V. A Proof that the Hindoos had the Binomial Theorem (AD 1790)” published by Reuben Burrow in 170, and reprinted in *ibid*, pp. 128–136.
28. Quoted from John Playfair, “Remarks on the Astronomy of the Brahmins”, 1789, reprinted in *ibid*, p. 101.
29. Quoted from Dharampal’s Preface to *Indian Science and Technology in the Eighteenth Century* (1971, reprinted edition, 2021), p. 6.
30. According to the 17th century Archbishop James Ussher’s chronology, Creation took place in 4004 BCE, dating the Great Deluge to 2348 BCE; for details, see James Barr, 1984–85, “Why the World Was Created in 4004 BC: Archbishop Ussher and Biblical Chronology”, *Bulletin of the John Rylands Library*, 67: 604, Manchester University.
31. He elaborates on subsequent developments for the non-European world in general as follows: “Further, by the 1820s, most parts of the non-European world are no longer themselves. Their institutions, sciences and technologies are not what they were 50 or 100 years earlier, and have met the same fate as their political systems and sovereignty. By the 1820s or so, most of the non-European world had become – at least in European theory and most conventional history texts, if not actually in practice – ‘backward and barbarian’.” *ibid*, p. 5.
32. For details, see the historical document: “VIII. An Account of the Manner of Inoculating for the Smallpox in the East Indies (AD 1767), by J Z Holwell, F.R.S. addressed

- to the President and Members of the College of Physicians in London, 1797, reprinted in *ibid.*, pp. 169–187.
33. See the historical document: “XVII. Aspects of Technology in Western India (AD 1790–1801)” by Dr. Helenus Scott, M.D. to Sir Joseph Banks, President Royal Society, London, manuscript, published in *ibid.*, pp. 284–292, esp. 287, 289–90.
 34. See the historical document: “XIII. On the Drill Husbandry of Southern India (AD 1795 & 1796)” by Captain Thomas Halcott, manuscript dated December 31, 1795 and January 10, 1796, published in *ibid.*, pp. 227–236.
 35. For details, see the historical document: “XII. Indian Agriculture (cir. 1820)” by Major General Sir Alexander Walker, manuscript published in *ibid.*, pp. 201–226.
 36. For graphic details, see the historical documents: “XIV. Iron Works at Ramanakapettah (AD 1795)” by Dr. Benjamin Heyne and “XV. The Mode of Manufacturing Iron in Central India (cr. 1829), by Major James Franklin, Bengal Army, F.R.S., M.R.A.S, both manuscript reports published in *ibid.*, pp. 233–236 and 237–270, respectively.
 37. For details, see the historical document: “X. the Process of Making Ice in the East Indies (AD 1775)” by Sir Robert Barker, F.R.S., published in 1775, reprinted in *ibid.*, pp. 192–195.
 38. For details, see the historical document: “IX. The Method of Making the Best Mortar at Madrass in East India (AD 1732)” published by Hon’ble Isaac Pyke, Governor of St. Helena, reprinted in *ibid.*, pp. 188–195.
 39. For details, see the historical document: “XI. Uses of the *Son* and Manufacturing of the Hindostan Paper (AD 1774)” published by Lt. Col. Ironside, reprinted in *ibid.*, pp. 196–200, and Appendix B of this essay.
 40. For more details, see Appendix A, viz. a brief summary of the historical document “XV. The Mode of Manufacturing Iron in Central India (ca. 1829)” reprinted in *ibid.*, pp. 237–270, including an explanation of the smelting furnace, also accompanied by two other intricate diagrams (Plates VII and XII).
 41. For explanatory details of the illustrated instruments used in paper-making, see Appendix B: “Instruments used in the making of the paper (Plate IV)” extracted from *Indian Science and Technology*, *ibid.*, pp. 199–200.
 42. A selection of these diagrams (Plates V and VI) and the accompanying textual expla-

nation, in particular for the Drill Plough, is provided in Appendix C: “XIII. On the Drill Husbandry of Southern India (1795 & 1796)”, extracted from *Indian Science and Technology*, *ibid.*, pp. 227–232.

43. The PPST traditional Science & Technology Congresses were held in Mumbai 1993, Chennai 1995 and Varanasi 1998; published articles in the same field appeared in the PPST Bulletins (1980–1994); for details, see <https://www.ppstindiagroup.in>.
44. *Science and Civilisation in China* (1954–present) is an ongoing series of books about the history of science and technology in China published by Cambridge University Press. It was initiated and edited by British historian Joseph Needham (1900–1995). To date there have been seven volumes in twenty-seven books.
45. Besides the impressive research and publications by the Indian Academy of Sciences as well as of the National Academy of Science, India (NASI), the National Manuscript Mission (IGNCA) has located thousands, if not millions, of manuscripts throughout India which are waiting to be researched by historians of science and society.
46. Quoted from Dharampal’s Preface to *Indian Science and Technology in the Eighteenth Century* (1971, reprinted edition, 2021), p. 36.
47. Extract from “Indigenous Indian Technological Talent and the Need for its Mobilisation,” lecture delivered at the Birla Industrial and Technological Museum, Calcutta, October 1986, published in: *PPST Bulletin* 9 (1986): 5–20; republished in Dharampal: *Collected Writings*, 5 volumes. Mapusa: Other India Press, 2000, vol. 5, pp. 50–108. Other lectures with a similar bearing were “The Question of India’s Development” (IIT, Bombay, January 1983), “Some Ideas on the Reindustrialisation of India”, published in: *Rediscovering India: Collection of Essays and Speeches (1956–1998)*, SIDH: Mussoorie, 2003, pp. 172–184 and 185–191, respectively.
48. The colonial land revenue extraction (often amounting to about 80–90% of the local resources) was further compounded with systematic political and bureaucratic intervention. Then, towards the end of the 19th century, a colonially defined bureaucratic apparatus was set up which remained out of sync with the real needs of local communities. Details were elaborated by Dharampal in a preliminary note entitled “In-built contradiction between the British structured Indian state and indigenous, or even statutory, local communities or Panchayats”, July 1–5, 1965, p. 55; later incorporated in Dharampal, *The Madras Panchayat System: A General Assessment*, Impex India: Delhi, 1972, Vol. II, and reproduced in *Essential Writings* (2015), *op. cit.*,

- pp. 165–190. Dharampal also collected substantial material on taxes levied on trades and professions known as *mohturpha* and *veesabuddy* in South India; they constituted complicated graded taxes to be paid by all non-agricultural people, which were introduced more as disciplining measures for controlling and harassing the population.
49. In particular, the ideological factors were elaborated upon in Dharampal: *Despoliation and Defaming of India: The Early Nineteenth Century British Crusade*, Bharat Peetham, Wardha/Other India Press, Goa, 1999.
50. This refers to an extensive commissioned survey of about 2,000 villages carried out by a British engineer, Thomas Barnard, based on data collected during a five-year period (1762–1767) soon after the area around Madras came under direct British control. Since this survey is supplemented by detailed Tamil palm-leaf records, it contains a wealth of information not only on agricultural production and the variety of crop cultivation but also on the very elaborate distributive system, the diversity of demographic and professional composition and the wide range of ecological habitats. The research project is being pursued extensively by two of Dharampal's close associates, Dr. M D Srinivas and Dr. J K Bajaj. Emerging from this project are the following two publications by Jatinder K Bajaj and M D Srinivas, *The Land People and History of Kundratthur: The Abode of Murugan and the Birthplace of Sekkizhar* and *The Land People and History of Ullavur: A Locality that Reaped the Bounty of Palar*, both published by the IGNCA, New Delhi (in press).
51. Dharampal derived his differentiated insights from his familiarity with local community histories, in particular, *Jati puranas* which he maintained contained a wealth of data about community practices and believes. He himself started this research by consulting the volumes of the *People of India: Anthropological Survey of India*, Delhi 1985 ff whose voluminous empirical data, according to him, required more in-depth analysis.
52. For a differentiated understanding of these developments, supported by detailed empirical data, see Dharampal's extended article: "Erosion of Norms and Dignity, and the Origins of Callousness, Pauperisation and Bondage in Modern India", first written in 1981, and published in: *Rediscovering India*, op. cit., pp. 27–92.

APPENDIXES A, B and C

All plates referred to in these appendixes are provided at the end.

A: XV. THE MODE OF MANUFACTURING IRON IN CENTRAL INDIA (1829), summary of the text in Dharampal, *Indian Science and Technology in the Eighteenth Century* (1971), reprinted edition, 2021, op. cit., pp. 237-270.

First, here is a brief explanation of **Plate XIII (Figure 8.8)**: **Fig. 1 and 2** represent the front and back view of a small circular smelting furnace, very common in India. The chimney is exhibited by dotted lines; **Fig. 3 and 4** show a refinery used chiefly for decarbonising large masses for the manufacture of anvils, etc., worked by two pairs of bellows. **Fig. 5** is a small field black-smith's forge, constructed with oval bricks, and luted together by clay, which can be constructed in half an hour, and is a useful field-smithy. **Fig. 6** is a tube of clay, used in the refinery to preserve the ends of the bellows; **Fig. 7** is a tube of the same kind used in the small circular furnaces.

This description forms part of a detailed survey conducted by Major James Franklin of the Bengal Army in ca. 1829, whose report was submitted to the Court of Directors of the East India Company. The report, reproduced in the above mentioned chapter XV, contains specific and systematically ordered details of around 50 mines (visited by Franklin) situated in the districts of Jabalpur, Baragaon, Panna, Katola, and Sagur. Providing geological details, he underscores the wide range of ore produced that is highly "oxidated" and yields excellent malleable iron. The report draws attention to the simple forge and refinery technologies, by means of which the process of smelting and decarbonisation is performed, whereby charcoal is used universally for smelting iron. Whilst observing that the smelting furnaces, albeit "rude in appearance", Franklin praises the exactitude and uniformity of their proportions and precision of measurement, accompanied by a simplicity of methodology.

To exemplify this, here is a brief description of **Plate VII** (the historical illustration and extracted text is reproduced from Dharampalji's volume, *ibid*, pp. 245-247, 256 and 257):

"Geometrical Construction of the Furnace

To construct the outlines of the furnace geometrically (**Plate VII, Fig. 1 and 2**) rule an indefinite line AB which suppose equal to a large cubit of 24 digits or 19.20 English inches, and divide it into 6 parts; at C erect a perpendicular, then from C to E set off 6 parts and it will mark the central point of the greatest bulge, and consequently the point of greatest

heat; next, from E to F set off 6 more points, and it will mark the point of cremation; then again from F to G, 6 parts more, will mark the line, where it is necessary to recharge the furnace, after the burden has sunk thus low, and from G to D two parts more; will give the perpendicular height of the furnace, in 20 parts equal to 5 feet 4 inches of English measure.

To complete the figure, rule lines parallel to the base, through the points E, F, G, and D, and from D, Fig. 1, set off three parts to the left hand for the top; bisect it at J, bisect also the bottom at H, draw H, J, right angled at K, and it will be the oblique axis of the furnace (Fig. 1. K–J) bisecting all the parallels corresponding with CD (Fig. 2), then make the parallels AB six parts, E six parts, F five parts, and D three parts; rule lines through all these points, and the geometrical outline will be completed, the sum of the parallels in parts, corresponding with those of the perpendicular.[...]

The *Akaira* in particular is a most extraordinary implement, (**Plate VII, Figs. 4 and 5**); externally viewed it is a clumsy mass of clay enveloping the wind tubes (**Plate VII, Fig. 9**), but when it is considered that the complete fusion of this mass, and the perfect completion of the smelting process must be simultaneous results, this implement becomes the most important of all the appendages. [...]

The *Guddaira* is a wedge of clay used to adjust the vertical position of the *Akaira* when placed in the furnace; and the *Pachar* is an oblong plate of clay, used in walling up the orifice after the *Akaira* is placed, and adjusted; these figures and dimensions are given in **Plate VII, Fig. 7 & 8**; the *Gurairy* (**Plate VII, Fig. 6**) is a convex plate of clay; perforated with holes and used as a grate—through which the scoria are drawn off.”

Summing up his minute description, Franklin makes the following notable observation:

“All these serve to shew that the original plan of this singular furnace must have been the work of advanced intelligence, and that its geometrical proportions have been preserved by simple measures; hence though its original form may be changed by caprice or ignorance, its principle never can be lost so long as hands and fingers remain.” *ibid*, p. 259.

Then he provides a description of a refinery (with illustration, **Plate XII** and extracted explanatory text) as follows:

“**Plate XII** exhibits the refinery complete, with the refiner at work on his seat, the bellows-man plying the bellows, and various implements lying about—**A** the outside of the chimney, **B** a mound of earth to strengthen its wall, **C** the refining furnace, **D** a piece of crude iron undergoing the process of decarbonization (in dotted lines), **E** the bellows-man plying the bellows, **F** the refiner with an iron spike in his hand regulating the operation (the dotted lines showing the interior of the furnace), **G** a thick plate of iron placed at the bottom of the refinery (in dotted lines), **H** a fosse for the hammer man, **I** the anvil, **K** implements, and **L** a heap of charcoal.”

B: XI. USES OF THE SON AND MANUFACTURING OF THE HINDOSTAN PAPER (1774), reproduced from Dharampal, *Indian Science and Technology in the Eighteenth Century* (1971), reprinted edition, 2021, op. cit., pp. 196-200.

PLATE IV: INSTRUMENTS USED IN MAKING THE PAPER
(pp. 199-200) [*Figure 8.9*]

Fig. 1

- a. A stamping lever, ten feet long, and seven inches squared timber.
- b. Two pieces of wood, fixed in the floor, to support the axis of the lever.
- c. This end of the lever is pressed down by the feet of two men.
- d. Is a stick, suspended from the roof of the house, to which are fastened four ropes which support the arms of the workmen.
- e. The head of the stamper four feet long, and four inches squared timber, bound and shod at the point with iron.
- ff. A perpendicular section of a terrassed cistern, dug in the ground-floor about 4 or 5 feet square.

- gg. A square stone, in the bottom of the cistern, excavated in the middle, to receive the head of the stamper, by which the rags are beat to pieces. A person is stationed in the cistern, to supply the stamper with rags.

Fig. 2

- 1.1. A terrassed cistern, dug in the floor, 4 or 5 feet square, having two little eminences,
- 2.2. at the edge, to support the stick
3. occasionally.
4. A jar, lodged in the floor, to hold in readiness the prepared rags.

Fig. 3

- AA. Is made in the manner of the Chinese bamboo window-screens. The transverse lines are fine rush, or a grass, neatly bound with horse hairs, which makes the longitudinal lines.
- BB. Two sticks, to which the screen is fastened, and extended by the two sticks occasionally.

Fig. 4

A form of wood, with seven bars, to support the screen (**Fig. 3**). The bars are so fixed, as that their acute edges only touch the screen, that there may be no obstruction to the passage of water through the screen.

Fig. 5

- aa. Is a terrass, 4 or 5 feet square, inclined a few inches, that water may readily run from it.
- bb. A mat or board laid upon the terrass.
- c. The new formed sheet of paper laid upon the mat.

Fig. 6

A flat hair brush for spreading the wet paper upon the walls of the house.

Fig. 7

The double edged knife with which the paper is cut into a proper form.

C: XIII. ON THE DRILL HUSBANDRY OF SOUTHERN INDIA (1795 & 1796), brief summary of the text in Dharampal, *Indian Science and Technology in the Eighteenth Century* (1971), reprinted edition, 2021, op. cit., pp. 227-232.

This short report was written by Captain Thomas Halcott and submitted to the Board of Agriculture in London, accompanied by sketches of three ploughs (two of which are reproduced here, **Plates V and VI**), and published in the *Communications of the Board of Agriculture* (1797), Vol. 1. According to Halcott, drill husbandry, using four different kinds of plough, was practised in many parts of Southern India, but in Innacondah, it was the drill plough, used “universally” and since “time immemorial”, that caught his attention. Albeit simply constructed, it was more advantageous for the purpose of equally “dropping the grain” than the patent and expensive drill plough, introduced recently into Britain. Halcott’s concise description of the drill plough observed by him is as follows:

“It has three teeth about eighteen inches long, and ten inches asunder; through the upper end of each tooth, near the back, is inserted a hollow bamboo of an inch in diameter, and about three feet in length, these three bamboos are set upright, and their upper ends are brought nearly together, in the form of a triangle, and inserted through the bottom of a wooden cup. This apparatus is supported and made steady by cords, in the way of shrouds, which lead to different parts of the plough.” *ibid*, p. 228.

The grain, Halcott explains, is fed into the cup, not by any mechanism, but with absolute consistent constancy, by the dexterous fingers of a woman who walks beside the plough, so that the end result is a perfectly sown field without any vacant spaces.

Plate No. V

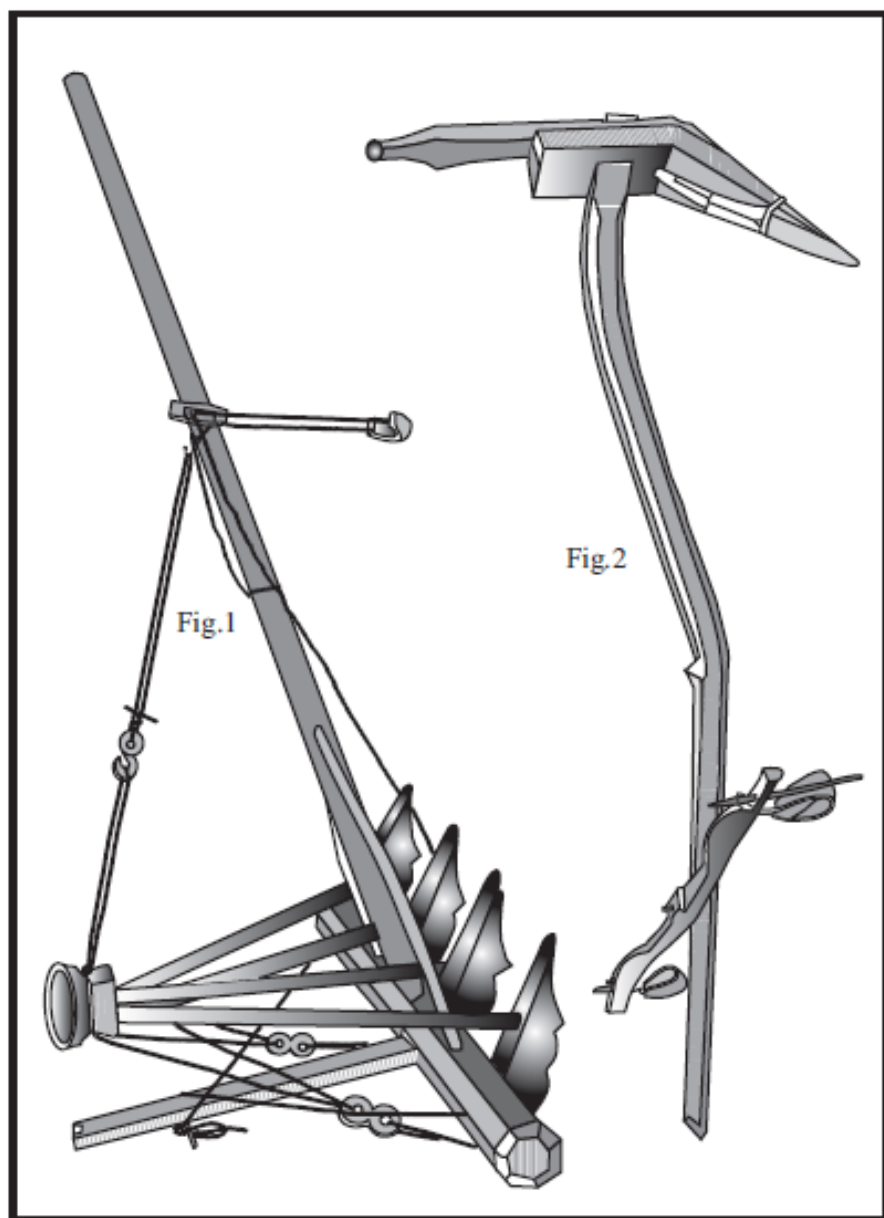


Plate VI

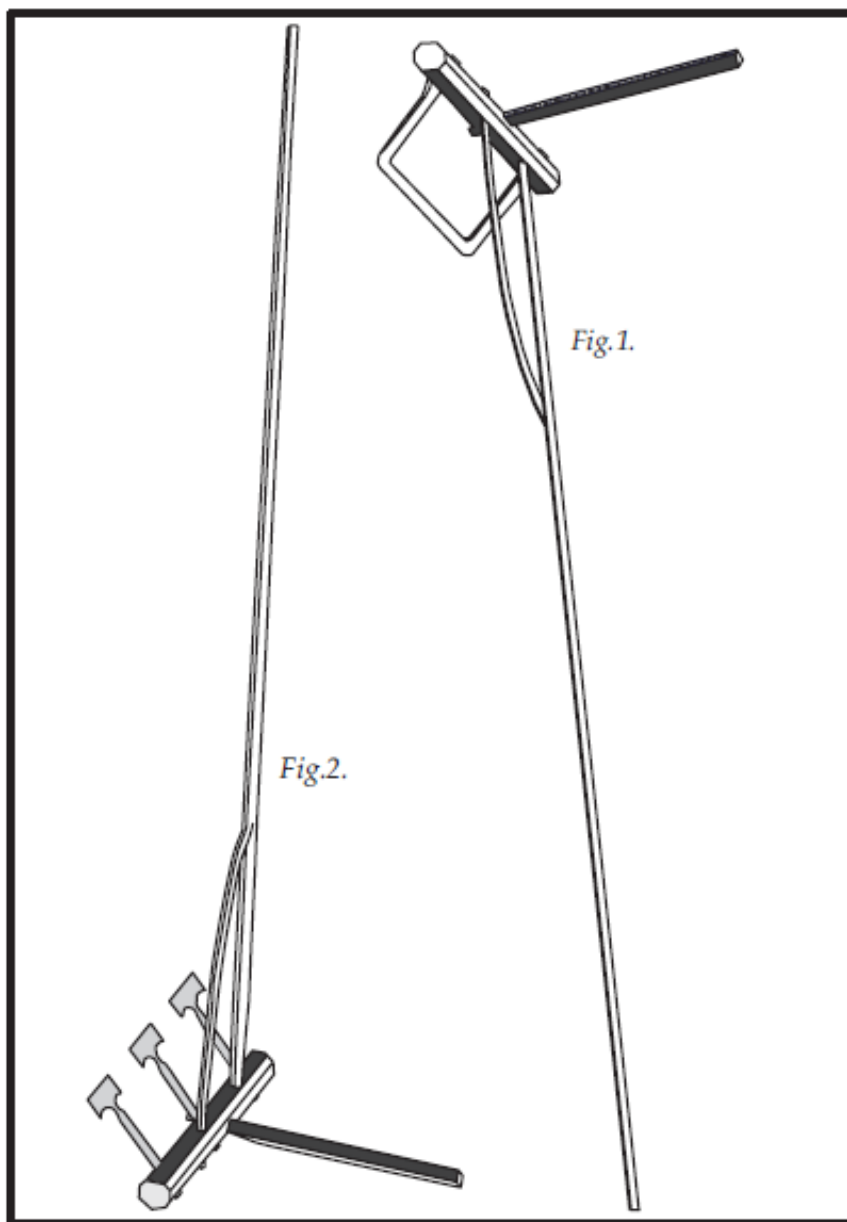
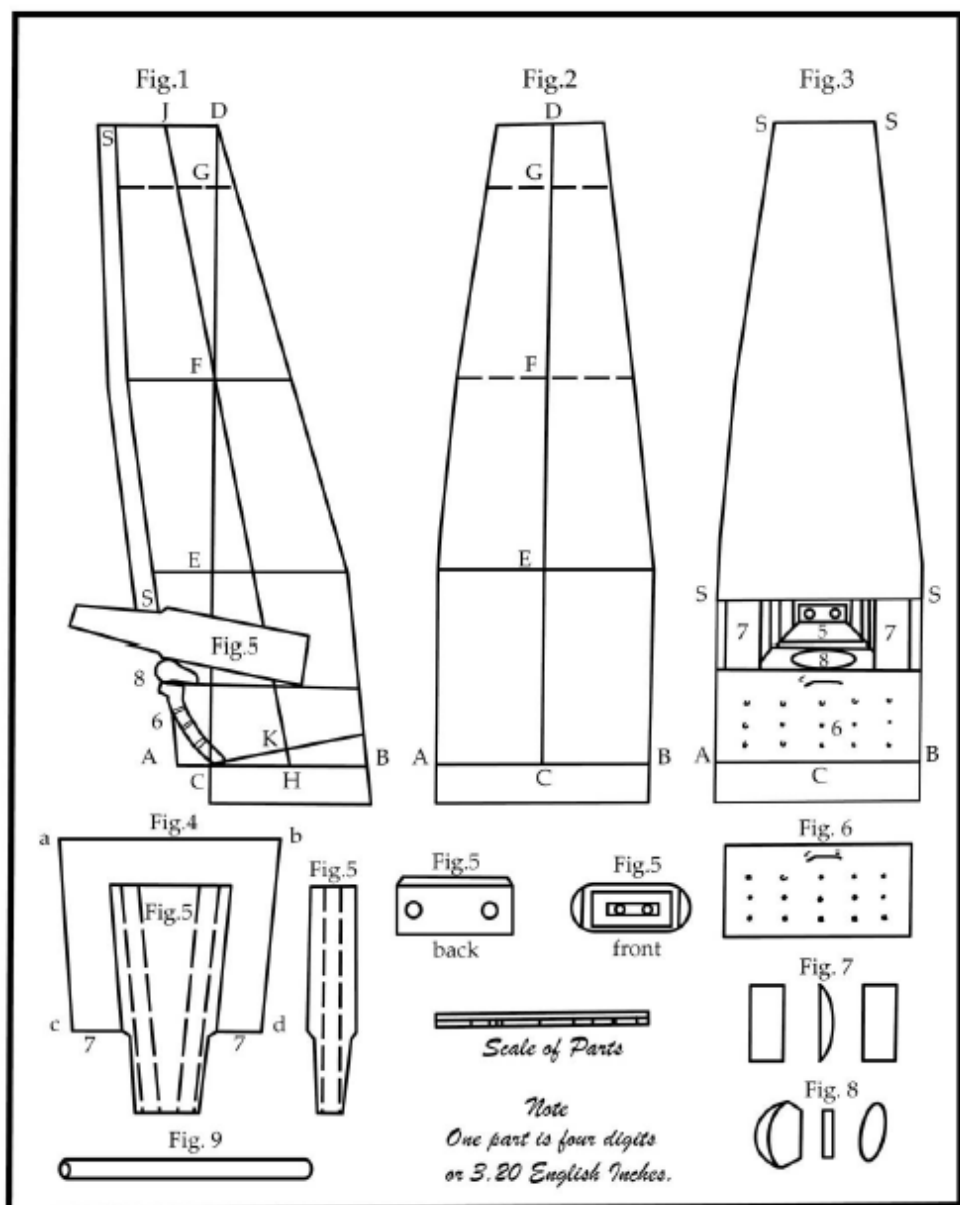
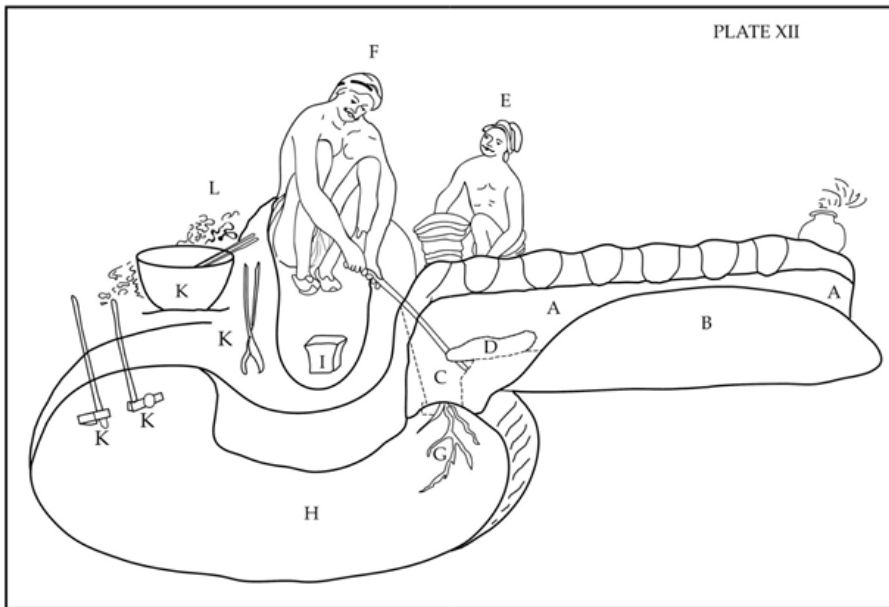


Plate VII





9

THINKING WITH HANDS: WORK AS FREEDOM

IASc-DBT Gandhi Lecture: 17 September 2021

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On 10 March 1922, M. K. Gandhi was arrested on the charge of sedition. In a routine form filled before the prison administration, he gave his profession as a ‘farmer and a weaver’. This small yet significant change in Gandhi’s self-description is often absent from the accounts of the ‘Great Trial’ of Ahmedabad.

Several years ago, on 14 April 1916, in an application for the enrolment as a life member of the Gujarat Vernacular Society, he had described himself as a ‘teacher living on my own labour’, and mentioned his monthly pay as less than 30 rupees [1].

Between these two bureaucratic form-fillings lies the story of not only Gandhi’s journey of self-perception but also a philosophical movement that sought a new understanding of work and its relationship with freedom.

Gandhi was called to the Bar in 1891, and he practised law actively at least until 1911; it was only after 1922 that he was de-barred formally by the Inns of Court. Being an attorney was central to his life, work and self-perception while he was in

YouTube lecture link: <https://www.youtube.com/watch?v=2UBEYWPkR04>

South Africa until 1915. Even when he stopped his legal practice and gave up his chambers, he did not cease to be an ‘advocate’.

This change in Gandhi’s self-perception has been explained either biographically or as a response to a specific context of a political situation – very often captured by a sartorial change. On 21 December 1913, Gandhi gave up what had been since September 1888 his favoured style of clothing – which can only be described as clothes befitting an England-trained barrister – and adopted the clothes of indentured labourer, a veshti and a short kurta. This gave way to the attire of a Kathiawadi peasant when he returned to India in 1915 and it remained the same with some modifications until 21 September 1921, when he adopted the short-dhoti and bare-chest attire with which he is most associated. While the politics of clothing and their symbolic meaning are necessary to understand Gandhi’s evolving relationship with clothing, and his greater and deeper identification with the *Daridra Narayana*, the poor as God, consideration of Gandhi’s evolving understanding of work, bodily labour and, for that reason, of body itself are not captured by the change in attire.

There was nothing in Gandhi’s social, economic, cultural and educational background that would have made him sensitive to bodily labour. For generations the Gandhi family had been administrators – Dewans of various principalities in Saurashtra. In no autobiographical account by Gandhi, or the vast biographical literature on him, is there a mention of the Gandhis being a land-owning family and engaged in agricultural activity even as absentee landlords. The absence of land-owning is significant, especially in the feudal political economy to which the Gandhis belonged. Land grants were common in feudal principalities, especially to the highest administrative officer, the Dewan.

There are also clear indications that the Gandhi family, both in Porbandar and Rajkot, had domestic ‘servants’ befitting their administrative, cultural and economic status. Thus, Gandhi’s early socialisation did not make him emphatic to bodily labour, except that which is rendered to elders as ‘seva’ service.

Gandhi’s recollections of his adolescent self also show a marked proclivity to avoid physical exercise, which he did only under duress, even at school. The only time that he was attracted to physical abilities, that of a stout body capable of running fast and jumping high and long, was when he convinced himself with the aid of his friend Sheikh Mehtab that meat-eating was necessary to drive away the British from India.

It was as a student in England that Gandhi came to be deeply attached to the lifelong passion of walking. The act of walking was central to Gandhi’s imagination, politics and self-practice. But the act of walking, either as politics, penance,

for maintenance of body's constitution, or as prayer, is not the same as work done through hands.

His stay in London as a student and later in South Africa without his wife Kasturba and their sons taught Gandhi valuable lessons in self-reliance; his parsimonious nature, frugality and his experience of racial discrimination made him self-reliant. Gandhi not only learnt to shave himself – the acquisition of this skill was important enough to be noted by him – but also cut his own hair in racial South Africa, happily participating in the mirth that it gave rise to. He dispensed with the regular services of a washing company, and learnt to wash and starch his barrister collars and cuffs. He tried his hand at cooking although he remained an indifferent cook and preferred to eat at vegetarian restaurants as a regular customer, even investing monetarily in them to make them solvent.

During his stay in South Africa, Gandhi also became an expert 'nurse'. The paucity or the near-absence of trained doctors and nurses for persons of colour and indentured labourers was the catalyst for the acquisition of this ability. As a young person in Rajkot thinking of a future in England, he had considered a life as a doctor, but cultural taboos and apprehensions precluded that possibility. But in South Africa, Gandhi found his calling as a nurse and could do 'concrete' service to fellow human beings. When a person with leprosy came to his door he had no heart to send him off with just a meal; Gandhi gave him shelter, treated his wounds and looked after him before admitting him to a government hospital for indentured labour. Gandhi trained himself as a nurse under Dr. Roberts Booth and learnt to dispense medicines as a compounder. This early training and passion was to make him an extraordinary 'quack' or 'an unta vaidya' in his words. By becoming a nurse, Gandhi had overcome a deep cultural bias of his Vaishnava family – both of touch that pollutes and a diseased body. Gandhi was to venture into a potentially hazardous terrain for himself and more so for Kasturba and their unborn child. On 22 May 1900 in their house Beach Grove Villa in Durban, Gandhi acted as an obstetrician-on-duty and delivered Kasturba of their last offspring Devadas.

It was in South Africa that Gandhi overcame what would have been a deeply held prejudice among all caste Hindus – that of cleaning human excreta. Gandhi adopted the practice of cleaning both the night soil and chamber pots not only used by him but by those who stayed in his house. In his autobiography he records with deep pain, anguish, penance and some embarrassment the incident involving Kasturba where he forced her with the unsympathetic zeal of a reformer to clean chamber pots for their house guests under great duress.

Those 'transgressions' prepared him to think about bodily work from a different philosophical and political ground.

He has recorded how reading John Ruskin's *Unto This Last* during a train journey changed his life. The establishment of the Phoenix Settlement, with its resolve to subsist by way of everyone contributing bodily labour, is attributed to the reading of Ruskin. The Phoenix community with its International Printing Press, journal *Indian Opinion* and agricultural plots that each settler was to cultivate sought to become a self-sustaining community devoted to labour and freedom. What Gandhi had felt and practiced in the private domain – though not without its societal aspects – the move to Phoenix gave him that on the level of a community of co-practitioners. This community through its thought and practice transformed the 'settlement' into one of modern India's most original and innovative experiment, the Ashram.

Apart from the influence of Ruskin's thought, Gandhi's deep and lasting friendship with Hermann Kallenbach helped Gandhi to think of ideas of working with hands. Kallenbach, who was introduced to Gandhi by barrister Rahim Karim Khan, was a bricoleur. He was born in Neustadt, East Prussia, in a Jewish family, trained and apprenticed as a mason, carpenter, building technician and architect, and was also a keen sportsman. Gandhi and Kallenbach shared lodgings at various places such as in the Orchards, three miles outside Johannesburg, and most famously in 1910 on a 1100-acre property of Kallenbach later named as the Tolstoy Farm, where they set up a colony for families of Satyagrahis and others to cultivate self-reliance through carpentry, gardening, sandal-making and austerity.

There were two significant influences that also helped shape Gandhi's growing fondness and enthusiasm for working with hands. One was contact with a community of Trappist monks residing in a monastery atop the Marianne hill outside Durban and the other was going to jail. The community of Trappist monks had deep impact on Gandhi's striving to create and nurture a community devoted to truth, nonviolence, seeking freedom and *moksha*. There are two distinct gifts that the Trappist monks gave to Gandhi, two different materials, two different practices and, for that reason, two distinct imaginations. One was sandal-making: Gandhi learnt, along with Kallenbach, to make leather sandals; the Trappist sandals in India became the 'Gandhi Patti Chappals' or the 'Sabarmati Chappals'. The other was architectural: The deeply etched memory of the chapel on Marianne hill and Kallenbach's carpentry and architectural sensibility are evident in the assembly of beams that Gandhi made for his house 'Hriday Kunj' on the banks of Sabarmati in Ahmedabad. The trusses used at Hriday Kunj are technically referred to as King Post Trusses – a closed triangle with a central post and two diagonal splayed struts.

Going to jail in South Africa often came with 'hard labour', and hard labour he did. His body was used to frugality and sparseness but not hard labour. The jail ex-

perience introduced a change in the life at Phoenix; food, sleep and work changed fundamentally. 'Hard' labour was made obligatory. Gandhi's grand-nephew Prabhudas Chhaganlal Gandhi remembers the time this change was introduced when he and Gandhi's youngest son Devadas were about 10 years old. One day Gandhi came from Johannesburg to Phoenix for some hours and left having made a profound change in the lives of the settlers. Prabhudas recalls: "The following day Bapuji came to Phoenix for some hours. He gave instructions to my father and Maganlalkaka about Devadaskaka's studies. Bapuji impressed upon Devadaskaka the need to start on a saltless diet from the next day itself. He paid no heed to the pleas of the elders to make concessions about the saltless diet. . . Moreover, he also gave clear instructions about the necessity of hard bodily labour of digging with a spade to be done every day in the searing heat of afternoon between 2 p.m. and 4 p.m." [2].

This was also the period when Gandhi was reading with close attention Tolstoy and the Bible, and his studies of the *Gita*, which had started in London, had deepened further. He knew of the punishment given to humans to live with the sweat of their brow in the Genesis (3:19). Tolstoy gave him the idea of 'Bread Labour', the obligatory labour to be done by all irrespective of their work. Gandhi's own reflection on the *Gita* enriched this idea of bread labour. The *Gita* speaks of 'yajna', sacrifice, as the basis of creation. The *Gita* says, 'together with sacrifice did the lord of the beings create' (verse 10: discourse III) and from 'sacrifice comes rain' (verse 14: discourse III). This sacrifice, this 'yajna', is the result of action. The *Gita* also advocated the supremacy of desireless, detached action. The question for Gandhi was how is one to cultivate action that is desireless, 'nishkama'. Gandhi's response was uniquely his. He argued that any action performed for others, yajna or sacrifice, is desireless action. The intertwining of bread labour and sacrificial action gave him the idea of sharirshrama, bodily labour, which became integral to his life and also an ashram vow. He was to call upon every Indian to offer sharirshrama as a contribution to the cause of freedom. This for him took the form of spinning, an activity that he termed as 'sutra yajna', sacrificial spinning.

His engagement with the material world was marked by his capacity to think with his hands, engage with materials to understand them and cultivate a transformative relationship. This engagement allowed him to understand the 'svabhava', the essence of the materials without the cultural attributes that were ascribed to them. By working with materials he not only sought to transform the material but also himself. He created through this process a new person, deeply modern, seeking to rid himself of the caste Hindu prejudice of being polluted by the material world.

Gandhi's work with the material world included a wide range of materials and work cultures, including the printing press (from writing and compositing to working the treadle), carpentry, leather work (from tanning to sandal making), agricultural work, sanitation work (both public and private sanitation), and the spinning, weaving and dying of textiles.

Gandhi was aware that just as there was a hierarchy of ritual purity and impurity, and impurity attributed to human beings lay at the basis of the practice of untouchability, a similar and largely intertwined hierarchy was attributed to the material world and work associated with it. Gandhi, by choosing to work with all the materials that were considered untouchable and polluting by caste Hindus, was seeking freedom from that prejudice. The dignity of labour that he so often spoke about and demanded was predicated upon breaking this relationship between bodily labour, pollution of materiality and the ascribed impurity of human beings. His desire for this freedom from hierarchy of his birth could only be attempted by work with hands. Hand work had to be given the same significance as thought; in fact one had to acquire the capacity of a craftsperson to think with her hands to attain this freedom. Work for Gandhi was a path to salvation.

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- [1] *CWMG*, vol. 13, P. 267. The rules of the society allowed for payment of concessional fee of Rs. 25/- as against the regular fees of Rs. 50/- for women and teachers with pay of less than Rs. 25/-. The society returned the fee and appointed him as an honorary life member.
- [2] Gandhi, Prabudas, *Jivan Nu Parodh*, (Ahmedabad: Navajivan, 1948), p. 203.

10

GANDHI ON THE WIDER SIGNIFICANCE OF SCIENCE

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I

It is well known that in his major work *Hind Swaraj*¹ as well as a vast number of dispatches, letters and speeches, Gandhi expressed a recoil from the various elements of modernity that he detected in the last two-and-a-half centuries or so of what he (somewhat omnibusly) called ‘Western civilization’. Central among these elements are science, capital, industrialisation, and the (centralised) state. In this brief note, I will focus on the first of these since I have been asked to speak about Gandhi’s views on science but – given the integrating links between them, – the rest will inevitably surface briefly in the discussion.

What is it about the outlooks around *modern* science (he would not have had any similar objections to, say, Aristotelian science) that filled Gandhi with qualm?

YouTube lecture link: <https://www.youtube.com/watch?v=dYbJj3h93sg>

Before I take this question up in detail, I want to draw attention to the fact that I am being careful to say that he had qualms about the *outlooks* around science, not science itself. Though I will, in my concluding remarks, return to this point and qualify it somewhat (or at any rate, raise a question about it), for the most part I believe that the point is right. Gandhi would have found it impertinent to repudiate science itself (for instance, repudiate something like Newton's laws). For the most part what he was criticising was not science but the fact that, in the modern period, science came to have a disproportionately dominant role in the culture and societies of European nations (more generally 'Western civilization'), shaping a whole outlook or ideology and a wide range of institutional constructions that had deleterious effects on the lives and mentalities of ordinary people as well as the natural environment they inhabited.

II

Let me begin with his views on modern medicine since that is what people find most controversial and then generalise from these to his broader understanding of the social and cognitive defects that have been generated by the role of modern science in societies of the West.

What makes his views about medicine controversial? The most obvious, though somewhat superficial, answer – and a source of constant dismay among his critics – is that he was perversely ignoring the great alleviation of suffering and loss of life that modern medicine can bring.

Gandhi's response to such criticism was often conciliatory, saying that he was not denying the fact of such alleviation, but only insisting on two related points. First, modern medicine often had effects that were very harmful and that this fact often tends to get buried in the triumphalist stories and statistics around its successes. And second, its successes were often founded and developed on the basis of practices like vivisection and other such procedures that both took and caused suffering to animal life (an early statement of what is pervasively accepted now among 'animal rights' theorists in the West).

But, in other remarks, he took the discussion to a deeper and less obvious level, probing the relations between modern medicine, and the traditional methods of seeking and providing cure.

He began this discussion by first *contextualising* medicine, saying some things were suited to certain kinds of society with certain sorts of prevalent attitudes and so, even if we acknowledge the gains brought about by modern medicine, it was not always appropriate in the Indian context.

To pursue this point, he would in some writings pose an initial challenge: Why does one find that traditional medicine survives in places like India, despite the growing availability of modern techniques? Why do people continue with healing practices that are traditional in the face of the impressive advances and the practical success of so much Western medicine, a question we might well ask today, many decades after he raised it. And he rejected as glib and evasive, and even somewhat cynical, the following answer: Traditional medicine continues to flourish in Indian modernity because otherwise its practitioners – the *vaid*s and *hakims* and *pirs* – would have to join the vast army of the unemployed. The answer is, in any case, false. No doubt some of them do carry on because they would be out of a livelihood if they did not, but to think that their practice does not come from and speak to a genuine belief and commitment on their part and on the part of their vast constituencies, would be to quite misdescribe the facts on the ground; moreover, to the extent that a range of low-tech solutions *do* work for many tropical afflictions and to the extent that they bring meaning and comfort to large numbers of people, it would be dogmatic to think that this belief or commitment is wholly misplaced. Gandhi insisted on this.

It is not as if this last point has gone unacknowledged in recent years in the metropolitan perches where Western medicine is practiced. The disdain many showed towards traditional medicine for so long has recently been qualified substantially, with considerable acceptance of the efficacy of traditional medicine, whether Ayurvedic or Unani or Chinese. In fact, major hospitals and universities in Western countries have increasingly devoted time, research and funds to teams and departments that study these efficacies. But this concession to his view does not quite come to grips with the deeper point of his differences with the *outlook* of modernity that surround medicine in our time. The chief difference lies in the fact that it is essential to this outlook that, having made the concession about the relative success of traditional medicine, it insists on asking the following further question and on giving the following answer to it, an answer that Gandhi stubbornly refuses.

The question is: Granted that traditional medicine is often efficacious, what *accounts* for its efficacy? What are the principles that explain why traditional medicine works, when it works? And everywhere (even, I'm sure, among most of us here today with our modern attitudes about science), there is a very strong tendency on our part to answer this question roughly as follows: "One need not deny that much works in the traditions of Ayurveda, Yoga, Unani, Chinese medicine, nor deny that not as much works as well as we assume it does in Western medicine, but still when we ask *why* each of these work when they work and explain how they work *we must appeal to the same underlying scientific (that is to say chemical, physical. . .) principles*. In

other words, the principles that explain the efficacy of various forms of traditional medicine and the principles that explain the efficacy of modern allopathic medicine *are not* and *cannot be* inconsistent with one another.”

Gandhi would, as I said, refuse this answer and it is his grounds for doing so that brings out how radical and deep-going his critique of modernity as it surfaces in our attitudes towards science is, and it brings out, therefore, why this is not just a surface dispute about the relative merits of traditional versus modern medicine.

To repeat, the intellectual demand of modernity that we are considering is this: the theoretical explanations of the instrumental successes of traditional forms of medicine must in the end be compatible with the theoretical explanations of the instrumental success of modern Western medicine. An implication of this demand is that if we take a certain widely held conception of a theory as a conjunction of inferentially related theoretical sentences, then the theoretical sentences which account for why western medicine works and the theoretical sentences which account for why these other traditions of medicine work, can be *conjoined in a single consistent theory*. There is no tension that pulls the conjoined theory apart in different directions. But Gandhi’s whole understanding of the context in which traditional medicine in India is practiced suggests to him that no such conjoining was possible. Indeed, that there was something incommensurate between traditional and modern medicine that made such a conjunction impossible.

What did Gandhi think was the source of this incommensurateness that thwarted the possibility of conjoining in a unified form the underlying explanations of these different efficacies? His answer was quite simple: The *very idea of efficacy* was different, in fact radically incomparable or incommensurate, in the two forms of medicine. That is to say, there was a conceptual divergence between what *counted as ‘cure’* in allopathic medicine and what counted as ‘cure’ in traditional medicine. How, then, could one expect the explanation of the success or cure to be, at bottom, the same, if the explananda (the data to be explained) were radically different, indeed incommensurate? To put it very facetiously, it would be like saying that we are going to give the same underlying explanation for why mountains are big and for why books are interesting! If there is incommensurateness in the two things to be explained, it would be absurd to demand that there be a common underlying explanation for both.

So, now, the next question arises, what did he mean when he said that the very idea of efficacy itself was very different in the two forms of medicine? His answer was: because they work with very different *conceptions of the body*. The relevance of this latter differential regarding the body to the differential in what counts as medical efficacy needs careful elaboration.

To do so, let me begin by citing a passage from a paper by Martha Nussbaum and Amartya Sen about health issues in a country like India which, though it is much more cautious than what Gandhi has to say, is a good start towards getting to the more radical position Gandhi takes. They write: “We need an ‘inside’ understanding of the people who are to be treated, in thinking about what is health and the procedures for bringing about health. Heavenly mathematics is one thing but medicine seems paradigmatic of something that is immersed, engaged, working in a pragmatic partnership with those whom it treats. It must take very seriously their pains and pleasures, their own mental sense of where health and flourishing lie. It involves the patient’s own sense of better and worse. To ignore this is not just to be callous. The important point is that *it cannot be right*.”² (The emphasis on the last four words is their own.)

Let me push further this interesting passage to take it towards a more ambitious claim than anything Nussbaum and Sen themselves say in it, something much closer to Gandhi’s understanding of the issues at stake.

Gandhi’s large point was that in many indigenous traditions, especially India’s, the notion of health and well-being turns on a conception of the body which is not purely and brutally material. Bodies (and more generally matter – the significance of saying “more generally matter” is something I will return to a little later) are shot through with what we contemporary philosophers, with our secular habits of thought and secular vocabulary, call ‘meaning’ and ‘value’, though in more religious and pantheistic and animistic traditions the terms employed would be somewhat different in their rhetoric since these traditions took the source of value and meaning to be sacred. Gandhi, given his maverick religiosity (invoking strains of Bhakti, of Buddhism and Jainism, of his own background of Gujarati Vaishnavism, and even of popular Christianity), indulged in a wide range of this rhetoric of sacralisation when describing the human body. But whichever rhetoric we employ (religious or secular) the upshot is that, for Gandhi, the target of cure is not something brutally corporeal, it is not simply the destruction of bacteria or the restoration of physical function. Rather, to put it in Weberian terms, if one sees the body itself as ‘enchanted’ with meaning and emotion and value, then if there is to be cure of the body it will mean a highly *integrated* restoration, not just of physical function but a restoration of an equilibrium of meanings and value and emotions as well.

So, when herbal medicines are used in the context of traditional medical practice in India, they are not *just* targeting conditions of the body conceived in purely corporeal terms. They are targeting something much richer. The point can be conveyed with an analogy. One might think of the body that these herbal medicines are seek-

ing to target by analogy with how we think of a table on stage during a play. So, to press the analogy, we might say that just as the physical table is a stage prop or a bit of stage-design in the performance of a play, the physical body is the stage site in a performance ritual of cure. To see the body as merely corporeal and to see the efficacy of a cure as a mere restoration of corporeal functioning would be like seeing the table on the stage in a play as merely and brutally physical, say as a configuration of swarming molecules, rather than as a site of family conviviality, as it might be, or as a site of tense international negotiations. This is not, of course, how Nussbaum and Sen put things, so I am adding a certain Gandhian understanding of the metaphysics of the body to Nussbaum and Sen's more guarded description of things.

Now, the modern philosophical instinct, which I assume most of us here possess, is going to be quite predictable when confronted with this point. It is going to respond by proposing a clean bifurcation: "Even if the restoration of the equilibrium of emotions and meanings are essential to our conception of cure, why can't we see things as follows. When herbal medicines are used, what is going on is that they cure the body, the body seen as brute and disenchanted as modern science sees it, and we then expect that (merely) bodily cure to, in turn, do its subsequent *causal* bit in restoring the patient's equilibrium of meanings and emotions; and where it does not entirely do so, we may turn to non-physical therapies as well such as what happens, say, in psychoanalysis."

But such a bifurcating response is tone-deaf to a fundamental point that is being registered in the Gandhian picture.

For Gandhi things are much more *integrated*. The body *itself* is *suffused* with meaning, value, and emotion. It is not merely *causally* connected with these latter states of mind and being. The body and these states of mind are not dualistically and separately conceived, requiring to be connected by causality. As a result, on his picture, we cannot bifurcate the process into two, one part (herbal medicine made of the neem plant, say, or, in modern medicine, the antibiotic pill) targeting the brutally material body and restoring its bodily function, which (once that purely material cure is achieved) is expected to then *cause a subsequent and separate* restoration of a wider equilibrium of states of mind and peace of mind. Nor can we, in the cases when that causality does not work out, resort to saying that we can view the purely bodily cure (the neem ka patha or antibiotic) as one part of the cure, and then *supplement* it with a further second kind of cure (the performative ritual – which in the West might take the form of the regime of a talking cure such as, say, psychoanalysis) that address the states of mind and restores emotions and meanings. If, on the Gandhian metaphysical picture, there is much greater integration of body and states of mind in the way that

the body itself is conceived, there cannot be *two* (merely causally linked) targets that cure is seeking nor two processes of cure – there is just one integrated target and one process. The medicine itself must be approached, must be administered and taken, *with the right attitudes and understanding* if the medicine is to be efficacious in the *integrated* way that is being sought. Thus, to present the body in analogy with the idea of stage design is to see it in terms that make it impossible to assert the bifurcation Gandhi opposes. What sense would it make to say that the swarming molecules on the stage that configure the table we see are *causing* the other thing we see – the site of family conviviality or tense international negotiation? The two sets of concepts – molecular structure, tense negotiation – are simply too disparate, too mismatched (i.e. incommensurate) with each other, for us to make any sense of the claim that one is causing the other.

Once we grasp this, we can grasp why Gandhi cannot accept the modernist's claim that even if traditional medicine is effective, its effectiveness must be explained by the same principles of physical chemistry that explain the effectiveness of allopathic Western medicine. What the foregoing discussion makes clear is that, for him, 'effectiveness', 'efficacy', 'cure', and thus 'health' itself, are radically differently and incommensurately conceived by the two traditions because they work with quite different conceptions of the body. How could they, then, be explained by these same underlying principles? And if they cannot get a common underlying explanation, then the Western scientists' concession to the success of traditional medicine is not properly conceived. Traditional medicine is not just seeking the kind of thing that counts as success in modern medicine.³ So when the concession is made, it is made to something other than what is intended and sought in traditional medicine. By Gandhi's lights, it is only by failing to comprehend and by distorting what is meant by 'success' in traditional medicine that the modernist can even formulate the demand that there be an underlying common explanation for the medical successes in the two traditions. With a full and undistorted comprehension of it, of the sort I've briefly tried to sketch, the demand, for him, is not so much as intelligible.

III

I had said earlier in a parenthesis that Gandhi's view of the body as a richer site than is conceived in the curative conceptions of modern allopathic medicine is a special case of a more general commitment on his part that all of matter and nature is more richly conceived than modern science allows. Such a view of nature and matter was taken for granted in popular religion for centuries in virtually every part of the world and is even present in a long tradition of Romantic thought in the West

(where it was not necessarily religious – Shelley, after all, was condemned for his ‘atheism’ – but often derived from, among other things, the legacy of Neo-Platonism). In Gandhi’s own thinking it derived from the wide range of religious influences that shaped his thinking, which I have already mentioned. In line with these influences, he believed that the world we inhabit (including nature and, as I’ve said at length already, even our own bodies) is sacralised by the presence of divinity and thus shot through with value and, as a result, it fell outside the domain of what is studied by the natural sciences.

This conception of nature was one important ground and source for his quite constant criticisms of modernity because it was only with the rise of the new science in the modern period that the idea of a sacralised nature began to be unsettled in a process often described as ‘the disenchantment of the world’. As I’ve said earlier, it was actually a result not so much of the rise of modern science itself, but of the position of dominance that natural science had begun to be given by the institutions around it that first emerged in the second half of the seventeenth century (such as, for instance, initially the Royal Society in England), institutions that formed lasting alliances both with *High* (not popular) *Christianity* (in England, this was the Anglican orthodoxy) and with *commercial* interests.

This alliance of interests developed a world-view according to which *the very idea of nature was equated* (without remainder) with ‘*that which the natural sciences study*’.

Just to be historically scrupulous, I should point out that such a world-view was, in fact, formulated before the late seventeenth century by earlier figures such as Galileo and Descartes in the European continent, and Bacon, Hartlib and others in England. But it did not gain the social and political influence it came to have until somewhat later, when the institutional structure around science and these alliances I mentioned were forged. The Royal Society was not formed until 1660, and it was much more than a scientific body; it had a membership that is best described as containing both scientists and scientific mandarins, and it was actively instrumental in forging the alliances that consolidated and spread the outlook.

Newton was a towering and crucial figure in these late-seventeenth century developments. His metaphysical ideas about God fed into the ‘disenchantment of the world’. Well before the ‘Death of God’ was announced by Nietzsche (actually, Hegel before him), Newton’s metaphysics arranged for what might be described as the ‘Exile of God’, the removal of the God that was conceived as being present *in* nature and matter, to a providential role and place *outside* the universe. The universe of matter and nature was now declared by the metaphysics to be inert and motion was

to be accounted for by an Archimedean push by God from that *external* station. This was in strict opposition to the popular religious view, which placed God everywhere *in* nature, democratically available to the visionary temperaments of ordinary people (not just accessible to the learned scriptural judgement of university-trained divines), and whose presence in matter and nature provided an *inner* source of dynamism responsible for its motion.

Of course, Christianity and other religious views well before this Early Modern period of my focus, did also frequently conceive of God as ‘transcendent’. But ‘transcendence’ in that traditional sense – though, obviously, it was contrasted with immanence – did not get presented as my very deliberately chosen rhetoric of ‘removal’ and ‘exile’ presents it. This rhetoric is intended to capture the notion of transcendence as it came to be understood from the Restoration onwards. Now, the expression to describe the God that was subjected to this removal or exile is not merely a ‘transcendent’ God, but ‘Deus Absconditus’. Absconditus, roughly means ‘*put away for safeguarding*’. What was the great *need* for God to be safeguarded by being put away in a providential posting outside the universe of matter and nature? Because, as I said, God, was conceived by popular religion in the revolutionary period immediately before the Restoration in England, as immanent in nature and matter and therefore available to the visionary temperaments of the most ordinary people, and this was thought to have dangerously democratising implications. The alliances I mentioned were keen to tarnish those implications as dangerous ‘enthusiasm’, a term of opprobrium, to describe the malaise that had infected the dissenting radical voices of the English revolution and their ‘levelling’ aspirations.

I’ve been taking care to say that it was Newton’s *metaphysics* (not physics or what was then called ‘natural philosophy’) that repudiated this popular conception. There was nothing in the laws of Newton’s physics that warranted this exile of God. The laws of motion were just as compatible with the popular religious metaphysics of God’s immanence in nature as they were with the ‘clockwinder’ God of exile. It was Newton’s metaphysics or, as I put it earlier, the *outlook* around the new science he had presented, which lay behind the equation of nature with what the natural sciences study, amounting to what Weber described as the ‘disenchantment of the world’.

Gandhi, of course, was not schooled in any of this intellectual history, but it is clear from his writings about a sacralised nature that his own outlook stood stoutly against these ‘disenchanting’ developments that came with the rise of modern science.

All this might leave us with the impression (and I make this speculation with some confidence since I am speaking to scientists) that since *we* do not and cannot share Gandhi’s view of a sacralised nature, we must find ourselves in sympathy with the

‘disenchantment of the world’ that characterises our modernity. But that impression would be wrong.

This is because the disenchantment of nature, as I’ve described it, goes far beyond the de-sacralisation of nature. What I meant when describing the new outlook that had emerged since the late seventeenth century is that it declared the very idea of ‘nature’ to be equated with ‘what the natural sciences study’. What is the surplus disenchanting effect – beyond mere de-sacralisation – that this formulation of how nature is to be understood, brings? The answer to this question is vital to coming to grips with Gandhi’s remarkable foresight as an early and prophetic figure in our environmental concerns.

What occurred as a result of the concerted efforts of these alliances that were formed in the Early Modern period is not merely the exile of *God* but also – because it was widely taken for granted that the source of all value was divine – the evacuation of *value* or value properties from nature, leaving nature as containing nothing but the properties that the natural sciences study. What do I mean by the evacuation of ‘value properties’? I mean a refusal to allow a completely natural way of talking about and describing nature using the vocabulary of value (and disvalue) as having any real validity.

Consider a storm on the horizon. Of course, we often describe it in meteorological terms, using the vocabulary of *condensation*, H_2O ... but we often describe what is on the horizon as a *threat* to fishermen living on the coastline. When we do so, we speak quite naturally and unselfconsciously as if *threats are properties of nature*. But the natural sciences don’t study threats; they don’t study nature as it is described in such evaluative terms, in terms of value or, as in this case, of disvalue.

To describe nature and, more generally, the world we inhabit in value terms is to see it as containing properties that go beyond the properties that natural science posits. Thus, we can see the Godavari River as containing not just H_2O but also as containing value, as something good, something to be cherished and preserved, not polluted or dried out. ‘Good’, ‘cherishable’, etc. are descriptions of the world in value terms, not scientific terms. Gandhi insisted that the river’s goodness is *in the world*, it is a value property *of the river*⁴ (just as much as H_2O is a chemical property of the river) – though, as I said, *he* thought so because he assumed all value to have a divine source, but *we* need not do so; we may simply see value (or disvalue) as an irreducibly secular element in the world with no ulterior and sacred grounding.

But if one equates nature with what natural science studies, then value properties cannot be properties in nature and all this talk of goodness and value as intrinsic properties of the Godavari river is illicit. We are just illicitly projecting *our* valuing it or our

cherishing it onto the world when we describe *it* as good or cherishable. Gandhi reversed this understanding of value. In his view, *we* cherish it because *it* is cherishable, because it contains value. There are cherishabilities (i.e. value properties, or more simply, value) in the world and that is why we have states of mind like cherishing that *respond* to those cherishabilities or value properties. This is equally true of properties in the social world as it is of the natural world. When we see a young person bending down to pick up something that another older person has dropped, we see *considerateness* in the world. Considerateness is not something that we have projected onto that act. Similarly, we see cruelty when we see an upper caste person preventing a Dalit from taking water from a certain well. The cruelty is there just as much as the other properties (the human bodies of the Brahmin and the Dalit or the stone of the well or the H₂O in it) are there. So, the world (both the natural and social world) contains goodness, threats, considerateness, cruelty... and these are simply not the objects of scientific study.

Now, of course, unlike properties in the world such as H₂O, value or disvalue properties in the world, such as goodness and considerateness or threats and cruelties, are in some sense constitutively dependent on our capacities as human beings to perceive them as such. But that does not mean that we are projecting them onto the world. So, to return to our example of the threat on the horizon that the fisherman sees, there is no doubt that the perception of properties in the world such as threats depends constitutively on our (the fisherman's) feelings of vulnerability. But it would be quite wrong to conclude from this that there are only properties such as H₂O and condensation in the world *outside* and we are merely projecting our states of mind like vulnerability that are *within us* onto the world, when we see it as containing a threat. The world contains real properties like threats, over and above containing H₂O, condensation, etc. Why insist on this? Because threats outside in the world and vulnerabilities within us go conceptually together. They are conceptually matched. H₂O outside and the vulnerability within us are conceptually completely mismatched. To say that our vulnerability is a response to the H₂O sounds like high nonsense. There is a conceptual chasm between the two and no amount of science or philosophy can bridge the chasm and render the nonsensical claim into an intelligible one.

There is no doubt that when we move from examples in the natural world to the social world we inhabit, and move to more complex examples of value (and disvalue) properties in the world like considerateness (and cruelty), we are talking about value properties in the world that owe to complex social constructions. Even a cursory glance at Marx's labour theory of value reveals just how complex these social constructions can be. But the point in Gandhi remains that none of this social construct-

edness of many value properties gives us any right to conclude that we are projecting our states of mind (our subjective utilities, our preferences, etc.) onto the world. To say these are social constructions is to recognise the contributions of a variety of human relations to the world, but it does not cancel the fact that what is constructed are properties *in* the world. Anybody who has internalised the theory (say, the labour theory of value), which displays the nature of these constructions, will then *literally see the world* as containing value and disvalue (in that constructed sense), see *the world* as containing, say, exploitative relations and acts, just as they see considerateness or cruelty in the examples I mentioned earlier. This point is, in principle, no different from saying that someone who has internalised quantum physical theory literally *sees* the *electron* in the cloud chamber, and does not merely see some tracks in the cloud chamber. This cannot be said of someone who has not internalised the theory. The value-ladenness of our observation of the world is, in this sense, no different from the theory-ladenness of observation of physical objects and properties in the world. Anyone who has internalised the labour theory of value simply will *see* workers, production, wages, prices, profits and a wide range of other observable phenomena differently from those who have not internalised the theory. And *what* they see, i.e., the constructed value properties in the world they perceive, are not any less really present in the world than physical properties, for having emerged as constructions that reflect complex human relations.⁵

This insistence that the world itself contains such value properties was the entire basis of Gandhi refusing the tall claims that modernity has made on behalf of science's comprehensive reach beyond its proper dominion. He did not deny that we may abstract away from properties such as threats in nature and study only such properties in nature as condensation and H₂O. He would even admit sometimes (though not consistently in all his writings) that doing so can lead to a highly fruitful understanding of the world as is provided by natural science. Yet, he would insist that to say that gives one no ground to go on to say that the properties we have abstracted *away from* when we do natural science (the goodness in the river, the threat in the storm, the considerateness in some action or the cruelty and exploitativeness in certain social relations and acts) are not really present in the world we inhabit. To deny that they are present is to go beyond the de-sacralisation of nature to comprehensively disenchanting it. Gandhi, as we know, was against both de-sacralisation and disenchantment. But we, even if we do not share his view of a sacralised nature, can join him half-way in recoiling from this further outreach to such a further and complete disenchantment of the world. There is scope, even within our rejection of a sacralised nature, to hold out, therefore, for a *secular* enchantment of the world, by

insisting that nature and the world we inhabit quite generally can be *truly* described in value terms without any fear that this vocabulary is illicit or second-class. All we do when we hold out for this is to deny, as Gandhi did, the equation of nature with what the natural sciences study. This is a (partial) Gandhian position (partial because he thought, as we do not, that value properties in the world have a sacred source) that we can embrace without any anxiety about being unscientific.

Why do I say so confidently that there is nothing unscientific in thinking that there are properties in nature (such as value properties) that the natural sciences do not and cannot study? Because the only way to be unscientific is to say something that contradicts some proposition in some science. But no science contains the proposition that the natural sciences have full and exhaustive coverage of nature. It is not a proposition in physics, chemistry, biology, or any science that we know and respect. It is a proposition in *philosophy*; it is a proposition in a philosophical outlook that grew around natural science. And, as Wittgenstein once said, of some other proposition, 'it is so absurd, that only a philosopher would say it'.

Gandhi certainly did think it was absurd to claim that the world (including nature) contains no properties that the natural sciences cannot study. In fact, he thought the equation of nature with what the natural sciences study was a superstition of modernity. This was not only because it implied that our most everyday and natural ways of talking ('that's a threat on the horizon') is illicit, but because it bestowed science with a comprehensive reach that went beyond its proper limits. This was the centrality given to science in modernity that Gandhi lamented. To dethrone science from that centrality, he thought it important to point out that that values were everywhere in nature, that there was nothing unscientific about saying so, that it is only unscientific when one gives unscientific answers to *science's* questions – it is not unscientific to insist that not all questions (not even all questions about nature) are science's questions.

IV

Let me turn, then, to say something very brief about why it seemed so important to Gandhi to declare this outlook of modernity to be a bad philosophy, to be the new superstition of our time, replacing traditional ways of thinking that were, in fact, essential to preserve some sanity in the way in which we relate to the natural world we inhabit.

For Gandhi, the evacuation of value from nature by equating nature with 'what the natural sciences study' is just a first step to declaring a further transformation of the concept of nature, a second equation whereby nature becomes '*natural resources*'.

In his thinking, this was an inevitable further equation, once you make the initial equation. To over-intellectualise our relations to nature, as is done by the first equation, releases in us the further impulse to conquer and control nature by seeing it as one vast resource for our gain. His instinctive grounds for saying this was that if, instead, we see nature as shot through with *value* (something that falls outside the purview of natural science), we would show it a kind of respect that would put constraints on how we treated it, and the ground for that respectful treatment would be lost if it was evacuated of the presence of value properties, as is done by the initial equation.

This was an acute insight on his part, though it was presented by him in a very instinctive way. But anyone who knows how the outlooks around the new science in Early Modern Europe were developed in the intellectual history of the West over *the subsequent centuries* will recognise just how shrewd the instinct was.

So far, I have contested the equation of nature with what the natural sciences study, as Gandhi did, by pointing to the presence of value properties (whether grounded in the sacred or whether freed of them in a secularised conception of enchantment) in nature. The equation, I have said, had the effect of removing values from the *world* (including nature) and putting them in our *minds*, in our desires and ‘moral sentiments’, to use the terms that David Hume and Adam Smith did, claiming that talk of them being in the world was a fallacious projection of our states of mind onto the world.

Others in the West, however, contested this equation somewhat differently from the way Gandhi did. Without denying the claim in Hume and Smith that value is something that is grounded in our states of mind, various strands of thought nevertheless began to claim that it was too narrow a conception of nature to equate it with what the natural sciences study. Nature, they claimed, does indeed contain properties that the *natural* sciences do not and cannot study, though these are not values, which remain tied to our states of mind such as desires, preferences, wants, (subjective) utilities and – when loftier in their aspiration – moral sentiments. What, then, were these properties in nature that were claimed in later centuries to be outside the purview of natural science? The word that was most often used to describe them is ‘opportunities’. Nature contains opportunities and natural science does not study opportunities.

It is surely quite intuitively right to say that the world we inhabit contains opportunities. We often speak as if that is so and there is no reason to think that our speech in these cases is in any way inappropriate or that it fails to describe real properties in nature. Consider a prisoner saying of a certain open space of a certain size that he sees in a wall, ‘I see an escape route’. Now, he could have said, ‘I see an open

space of three-and-a-half feet'. If he did, we still have only a description of it in terms of the natural sciences (a bit of very elementary applied mathematics). It is only if he sees the same space as an *escape route* that he sees the world as containing an opportunity. And the escape route is just as much a real property in the world as the length of three-and-a-half feet. That is just one obvious example of an opportunity. Examples, and more complex examples, can be multiplied.⁶

But it is worth remarking again that in claiming that there were perceptible properties in the world that human subjects inhabit and that the natural sciences do not study, it was *only* opportunities that were allowed as such properties, *not values*, which continued to be restricted, even on this view, to our states of mind. So, it was not a reversal of the disenchanting outlook but only a partial revision of it. The reason for this becomes clear when one notices that this was a step in the construction of a certain view of the role of the *social* sciences. That is to say, natural sciences were denied full and exhaustive coverage of nature (by the allowing of opportunities – but not values – as properties in nature) only so as to make space for the social sciences to pick up the slack.

Under this partial revision of the outlook around modern science, the underlying role of the *social* sciences (by 'underlying' I mean the *overarching goal that lies behind* the various detailed claims and principles and arguments of the various, different disciplinary angles on the study of society) was now conceived schematically as

1. To identify the various states of mind of human subjects (their preferences, wants, desires, subjective utilities, moral sentiments) that comprised their '*values*' and rank them according to the relative strength with which they were held.
2. To present human subjects as probabilistically apprehending the opportunities in the world that would gratify those preferences, wants, etc.
3. To further present human subjects as pursuing in their actions those opportunities in the world that they apprehend as having the highest probability of gratifying the preferences that have the highest ranking.

In a word, the states of mind that comprised our values were the 'ends' that motivated the behaviour of human subjects in a world that they apprehended as containing the 'means' or opportunities for the satisfaction of those ends. Economics studied the material ends and opportunities, while the other social sciences distributed, with less regimentation, over a wide range of other ends and opportunities. This was the construction – essentially an emerging understanding of the place and role of the social

sciences – by which the idea of nature, equated (ever since the late-seventeenth century) with what the natural sciences studied, morphed over subsequent centuries into the idea of nature as equated with natural resources. The partial revision that introduced *opportunities* in nature was, in essence, the shift needed to generate its second equation with natural *resources*. This went hand-in-hand with a new understanding of what was hitherto merely the *study* of society as, now, social *science*.

Gandhi, of course, as I said, did not articulate these underpinnings in the intellectual history of this morphing as I have just done (he was a philosopher, after all, not a *salaried* philosopher) but he very early on understood in a much more instinctive way that the first equation was bound to lead in this way to the second. Hence, it would be quite insufficient, by Gandhi's lights, to contest the equation of nature with what the natural sciences study by allowing for only the presence of opportunities in nature. That may succeed in contesting the equation but it does so in a shallow way and permits us (by a different and further equation) to transform nature into natural resources – nature conceived as mere means while the values that are the ends are all still in our minds, in our motivational psychology. What we need to correct this is to see nature as containing the source of our *ends*, to see nature as containing value, the value properties that make normative demands on our states of mind and our motivational psychology. (On the philosophical significance of this point, see Footnote 4 above.) That alone would pre-empt the equation of nature with natural resources. That alone would prompt in us the right respect for nature that Gandhi sought, the respect that, once lost as a result of the second equation, spelt the inevitable doom of the environment that is everywhere lamented today.

For him, nature *sacralised* by the presence of a *divinity* provided the source of such respect and, therefore, stood in the way of treating nature as a mere bounty of resources but, as I have been insisting, nature *more secularly enchanted* by the presence of *values* in it, would equally stand in the way of treating it in that way. That is why it was so important in the project of capitalist modernity to evacuate value from nature and push it into the interior of human subjects, their states of mind, so that nature could be equated first with the properties that natural science studies and then, by the transition I have just expounded, with the natural resources that the social sciences study as opportunities or gratifiers of values, when values are so understood.

It is not as if, in rejecting this equation of nature with natural resources, Gandhi was denying that we do take from nature to fulfil our needs. He repeatedly acknowledged that human subjects have always taken from nature, ever since they came to inhabit it. But, as he also pointed out, in traditional societies in virtually every social

world we have known for centuries, there were rituals undertaken to show respect to and seek restoration to nature, before taking from it, that is, before cycles of planting, and even hunting. It is only with modernity and the asserting of these two equations, seriatim, over recent centuries, that we have adopted an outlook constructed around natural and social science that allows us to think that we can take from nature *with impunity*. It was *this* outlook and the place and role of the whole range of sciences in it that he saw as the philosophical basis of the various other elements of modernity from which he recoiled. In particular, capital, and the growth economies and industrial societies it spawned, aided at each stage by an increasingly centralised state, all grew out of this philosophical soil.

Whether and how we can recover the attitudes of respect towards nature that were exemplified in tradition (knowing as we do – if we are not deluded – that much of tradition itself is part of an unrecoverable past) is the large and vexing question that besets us now in our Late Modernity. We owe it to Gandhi to find a credible answer to it.⁷

V

I began this lecture by saying that in the arguments and conclusions I will present, Gandhi – for the most part – was not opposing science itself, but the outlooks that had grown around science in the modern period, when for the first time it had come to hold what he thought was too-dominant a place in European society and culture, making alliances with the commercial interests that grew around the rise of capital and the rise of an increasingly centralised state that largely served the interests of capital. But I had also pledged to conclude the essay by making one tentative and broad qualification to the caution I have shown in making such a distinction on his behalf between science and the outlooks around it. Let me, then, expend just a few concluding sentences to do so.

The fact is that Gandhi's own rhetoric was not always scrupulous in maintaining this distinction. He sometimes did speak as if 'science' itself – rather than the ideological and institutional constructions around it – was responsible for a variety of harms. How shall we read the submerged intention behind this rhetoric? Is it just an occasional and careless way of talking? Or does it reflect some further conviction on his part?

My hunch is that Gandhi did have a strain in his thinking, which – having identified various harms as owing not to science itself but to the overreach it was constructed to have by wider social, economic and ideological interests – then also sometimes suggested that it was *built into* the nature of science itself that it was *predis-*

posed to bring about such overreaching constructions around it. This is a much bolder thought than anything I have discussed so far in this lecture.

What is this notion of pre-disposition?

I myself have no clear answer to this question. And Gandhi himself did not elaborate very much on it either. Here again, it was an instinct conveyed by his rhetoric, rather than a fully worked out claim, on his part. The notion of a predisposition, which is sometimes deployed in biology, may have a relatively clear application there, where it can be said to have some underlying genetic basis. But when it comes to attributing a predisposition to a cognitive-cum-social practice like science, there is no such grounding remotely in sight, and so the notion of predisposition remains hazy. Still, it is not obvious that Gandhi's occasionally expressed instinct that there is such a predisposition should be discarded without much greater reflection on the matter.

What is clear is that there is no *logical* connection between science, and the ideological and institutional overreach that has been made on its behalf over the last few centuries. One does not *entail* the other by any codified form of reasoning. One simply cannot read off the wider effects in outlook and institutions from anything in the laws and generalisations of, say, physics or chemistry. But even if there is no logical inference of this sort from one to the other, the question can at least be raised, whether science – by the very kind of cognitive enterprise it is with the kind of explanatory and predictive ambitions it has – *tends* to be, and is *susceptible* to being, taken to places beyond its proper dominion. These words 'tends to', 'susceptible to' and the earlier 'predisposed to' that I have used are intended to contrast with 'logically entails', and it is a vocabulary that sits well with Gandhi's own rhetoric by which his instinct is conveyed.

I repeat: I don't think we should pretend to fully understand exactly what these words convey. A predisposition of this sort attributed to science is not an easily made out attribution. It is not even clear what exactly it is that is being attributed. Even so it does hint at a nagging possibility (one that has also been expressed by other thinkers such as Nietzsche, Heidegger, Horkheimer and Adorno, and in recent years even in a very sophisticated and more theoretical domain, by Chomsky). And, once again, we owe it to Gandhi – given how profound so many of his other instincts have been – to explore the possibility with more rigour and detail than he was able to provide.

NOTES

1. M. K. Gandhi, *Hind Swaraj*, Navjivan Trust, 2010 (Originally published in 1909).
2. Martha Nussbaum and Amartya Sen, 'Internal Criticism and Indian Rationalist Traditions', *Working Paper of the United Nations Development Economics Research*, United Nations University, 1987.
3. In recent years, feminists have been formulating a critique of mainstream medicine in the West as working with a wrong conception of the body. Gandhi was an early pioneer of this criticism.
4. For the temptation (one that Gandhi's own outlook resisted) to see the goodness or value of a river as not intrinsic to it but owing derivatively to the fact that it is a resource for human inhabitants of nature, see the discussion later in the paper on 'opportunities' as properties of nature that contrast with value and goodness as properties of nature. However, resisting this temptation does not mean we have to deny the point that I make immediately further below viz., that intrinsic value (or disvalue) properties in the world are constitutively dependent on our capacity to perceive them and be responsive to the normative demands they make on us.
5. For an interesting elaboration of science along lines that have affinities with what I am unearthing (and modifying along secular lines) in Gandhi, see Roy Bhaskar's *A Realist Theory of Science*, Routledge, 2008.
6. The psychologist J. J. Gibson gives an extremely interesting underpinning in the psychology of perception of this idea of opportunities, as I've presented it here. See his notion of 'affordances' in his best-known work, *The Senses Considered as Perceptual Systems*, George, Allen and Unwin, 1966.
7. For more on these themes and this question, see the essays in the section on 'Enchantment', in my book *Secularism, Identity, and Enchantment*, Harvard University Press, 2014.

The power of science to do good for humanity is immense, but it also has an immense ability of destruction. Mahatma Gandhi's view that 'science without humanity' is a social sin is as apt today as when it was first said.

To discuss and understand the impact of Gandhi's views and philosophy on how science can shape the future of humanity, the Indian Academy of Sciences and the Department of Biotechnology instituted the Gandhi Lecture Series on *Science and the Future of Humanity*, in celebration of Mahatma Gandhi's 150th birth anniversary. This series of lectures, delivered by some of the most eminent thought leaders, span the spectrum of conversations on environmental sustainability, innovation culture, solidarity, ethics and many others that are of paramount relevance today.



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